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New Punching Press.

We illustrate on this and the next page a new punch press, designed by Mr. Oberlin Smith, and built by the Ferracute Machine Co., of Bridgeton, N. J.

The frame of this machine, while so formed and proportioned as to give great rigidity, is further strengthened by internal ribs in all those parts which bear tensile or compressive strains, the result being that very great strain can be imposed upon the machine without objectionable or deleterious springing, tending to displace punch or die.

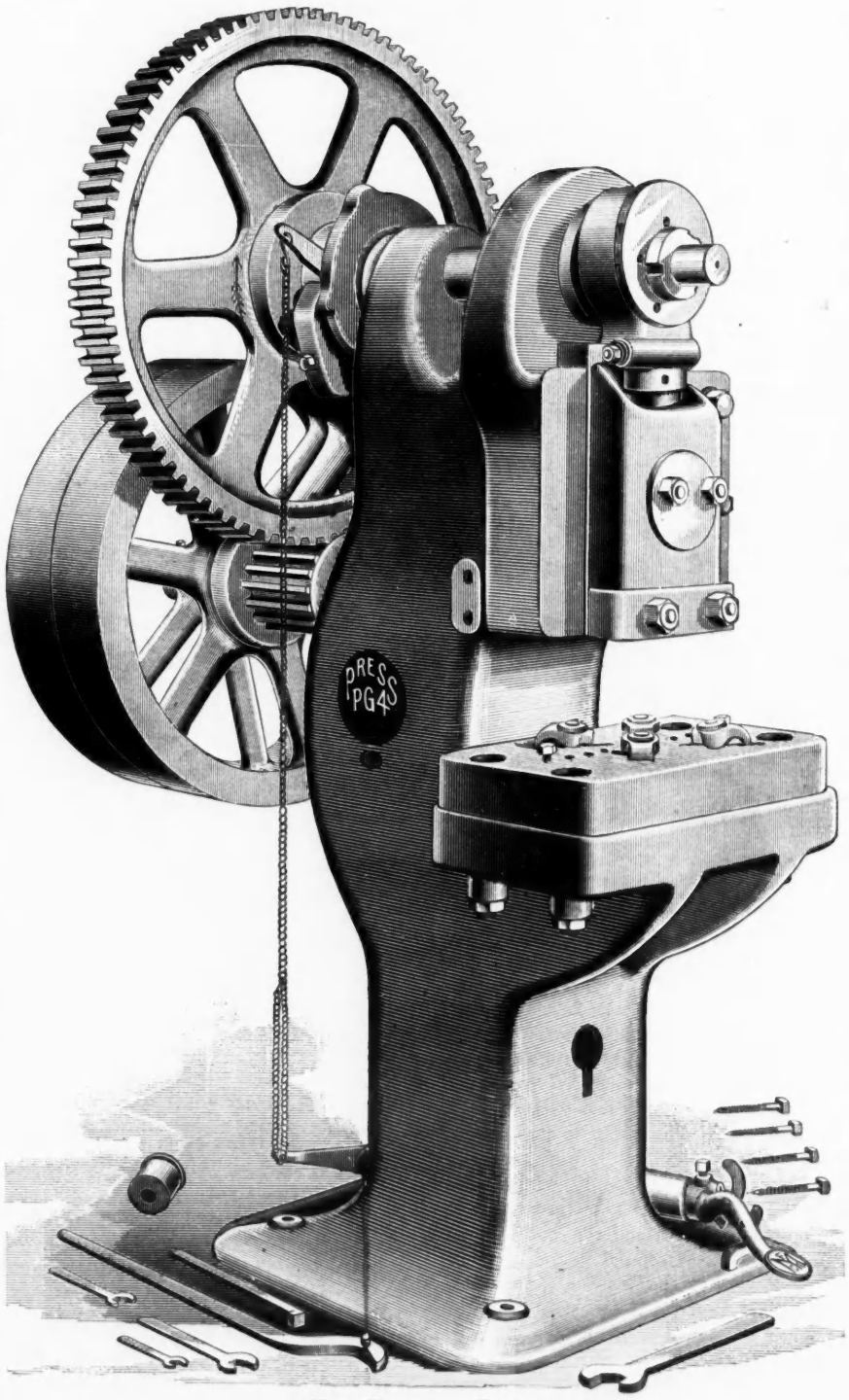
The pitman is of recently improved construction, its stem, while having the advantage of a screw adjustment, being so firmly gripped both at its upper and lower ends, in the pitman pivot and strap respectively, as to give the effect of solid metal between shaft and ram, these gripping devices at the same time being very delicate in their adjustment.

The ram is unusually heavy, and is arranged with very long and wide bearings; an extra long pitman adjustment, graduated to hundredths of an inch; proper arrangements for clamping various kinds of punches; a positive knock-out when desired, etc. The bolster can be made to order with various sizes of central hole, and is provided with die clamps, adjustable in T-slots upon the top face.

The shaft is of forged steel, with unusually large and long journals. In an enlargement of its solid metal is mounted an automatic stop clutch of the utmost simplicity, and which, withal, has its different members so interlocked with each other in the process of assembling, as to require no nuts or screws whatever, these being objectionable in a device of this kind, where the tendency is constantly to knock them loose. This clutch is provided with a safety lock which, while performing other functions incidentally, can be so manipulated as to prevent the press from starting while dies are being set, etc. A new and valuable feature consists in a so-called "clutch plate," carrying the tripping device, which is adjustable around the shaft's axis, thus allowing the clutch to be tripped either earlier or later than the normal, to accommodate itself to varying degrees of momentum in the shaft and parts attached thereto, this momentum being dependent upon the conditions of speed, lubrication, extra weights upon shaft (as cams, gears, pulleys, etc.), and other circumstances which usually have to be controlled entirely by a brake, thus in many cases losing a large amount of power. In the hub of the large gear, besides four hardened wheel studs for driving, there are also mounted self-acting locking pins, which, while allowing the clutch slide in shaft ample time to enter spaces between wheel studs, finally lock the same after entering, and thus prevent the annoying back-lash incident to the use of spring drawing dies and elastic work of various kinds.

The mechanism of the clutch will be readily understood from the detail engraving on page 2, in which G is an enlargement of the shaft to contain a part of clutch mechanism, and is called the "clutch collar." Surrounding the clutch collar is the clutch plate E, which is firmly fastened to frame of press by clamp E and brake stud S.

On a stud L, firmly fastened in clutch plate E, is carried the clutch lever L, which enters an annular groove turned in the clutch collar, and which normally is held up against the shaft by a C-spring F, one end of which enters a hole in the clutch plate; the other passing beneath the clutch lever L enters a countersink therein and forces clutch lever counter-clockwise (from right to left), revolving on stud L' against the shaft.



NEW PUNCHING PRESS.

The clutch slide B intersects the annular groove in clutch collar, into which clutch lever L enters, preventing clutch slide B from being driven out of clutch collar by the hair-pin spring B'. The clutch lock A in its normal position prevents clutch slide B from revolving and from being forced too far out of clutch collar. Should clutch lock A be forced downward by hand it prevents the clutch slide B from being driven out of clutch collar at all. The clutch-lock pin C, entering countersinks in clutch lock A, and being forced against it by a spring, firmly holds the clutch lock in the two positions mentioned. Mounted on the brake stud S are the brake blocks D, D, which being drawn together by the brake bolt D' press against the clutch collar and effectively act as a brake.

The dead stop T is a pin intersecting the annular groove in which enters clutch lever L. Should shaft overrun its natural stopped position (being carried only by its momentum) the dead stop T will strike against the clutch lever L and stop the shaft positively. Clutch lever L has an incline at l, upon which clutch slide B mounts as shaft revolves in the direction shown, and which forces clutch slide B into the clutch collar to the position shown by drawing. Clutch lever L is connected to the treadle of press by a chain, so that when treadle is depressed, clutch lever is drawn downward. In operation the clutch works as follows:

The treadle being depressed, clutch lever L is drawn downward out of contact with clutch slide, allowing clutch slide to be forced by spring B' out of clutch collar when it engages with one of a number of studs projecting from the revolving fly-wheel and shaft is forced to revolve. The treadle being released, the clutch lever is lifted to the position shown by drawing, by the spring F, and the shaft continuing on its counter-clockwise revolution, the clutch slide B is forced against the incline at l on clutch lever L, and so clutch slide is drawn into the clutch collar, thereby disengaging the clutch slide from the fly-wheel; consequently the shaft stops after being carried somewhat further by its momentum. The stopped position of shaft may be regulated by adjusting clutch plate E', carrying the clutch lever, etc., around the shaft so that clutch slide may sooner or later, as required, mount the incline on clutch lever, thereby disengaging the shaft from the revolving fly-wheel. Of course the brake will regulate the amount shaft revolves after clutch slide is withdrawn from the fly-wheel. Should it be desired to make the clutch inoperative so that any accidental depression of treadle will not cause the shaft to revolve, forcing clutch lock A to its lower position will prevent clutch slide B from being forced out of clutch collar to engage with fly-wheel studs, even though clutch lever may be depressed. Consequently shaft cannot be revolved by depressing treadle when clutch lock A is in its lower position.

The perspective engraving is about $\frac{1}{12}$ size of the machine which weighs about 4,400 pounds, there being three small sizes and two larger ones of the same design, and ranging in weight from 975 to 9,600 pounds. The same presses are also built without gears.

The dimensions of the press illustrated are as follows:

Hole through bed, 8″x10″; depth of throat, from ram center back, 8½″; height from bed to ram at top of stroke and adjustment, 10″; standard ram stroke, 1½; special ram stroke to order, anything up to 4″; adjustment of ram, 3″; fly-wheel, 32″x 5″; weight of fly-wheel, 425 pounds; speed of fly-wheel, 300 revolutions per minute; speed of main shaft, 50 revolutions; thickness of iron punchable with 1″ round dies, $\frac{11}{16}$″; thickness of bolster, 3″; pressure safely exerted by ram, 52 tons.

The recent train robberies on Western railroads has stirred up railroad officials in that section to a general arming of train crews, which will very likely put a stop to the practice. It is not lead that the gentlemen who rob trains are looking for.

One of the latest moves made in the way of blocking business is the closing up of the cotton gins in parts of the South by order of the "regulators." Threats were made that all gins operated before the price of cotton reached ten cents per pound would be burned, and gin owners ceased operations. The means employed to raise the price of cotton was scarcely worse than means employed sometimes for similar pur-

poses under a semblance of legal sanction, but, of course, the matter will not be looked upon in the same light.

Notes from the Fair.

Editorial Correspondence.

When it comes to arranging display pieces, brass goods and the smaller supplies afford an opportunity that is not lost on the exhibitor of artistic taste. Brass goods finish nicely, and they stand nickel plating to almost any extent without showing that it is done for display, because it is easily demonstrated that the nickel saves both time and material in cleaning. The shapes of a good many of the pieces very often favor their location on walls, and in pyramids, etc., blending the useful and the ornamental without much effort.

There are a good many exhibits here of the kind referred to, many of them having a very pleasing effect, but for lack of space only a few can be referred to.

A very neat exhibit of the kind is made by the Penberthy Injector Co., of Detroit, Mich. The space occupied is not large, but it is covered over and looks inviting until you see, at the back end of the space, a small boiler and engine. Upon finding out that these are "not loaded" the temperature drops, in imagination, several degrees. I believe that it was at first intended to use this boiler to illustrate the working of the Penberthy injector, but the heat of the building—Machinery Hall—made this inadvisable in the warm months, so the boiler only serves to show an injector attached as it would be if doing duty. The "front fence" of this exhibit is made principally of injectors and ejectors, with oil cups for trimmings, the goods made by the firm. These work in so well that they look almost as if made for the purpose.

One of the features of the Penberthy injector is the ease with which it can be cleaned. Thus by unscrewing the plug at the bottom of the sketch, Fig. 1, the tubes will follow it out and can then, of course, be readily come at for cleaning and inspection, the body can be blown through and the tubes and plug replaced without any disturbance of the connections.

Two kinds of oil cups are exhibited—one for ordinary use and the other for crank-pins. In the first one named, the cover is held to place by means of a helical spring attached to the cover and passing down

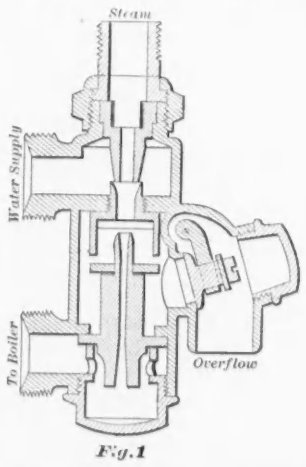
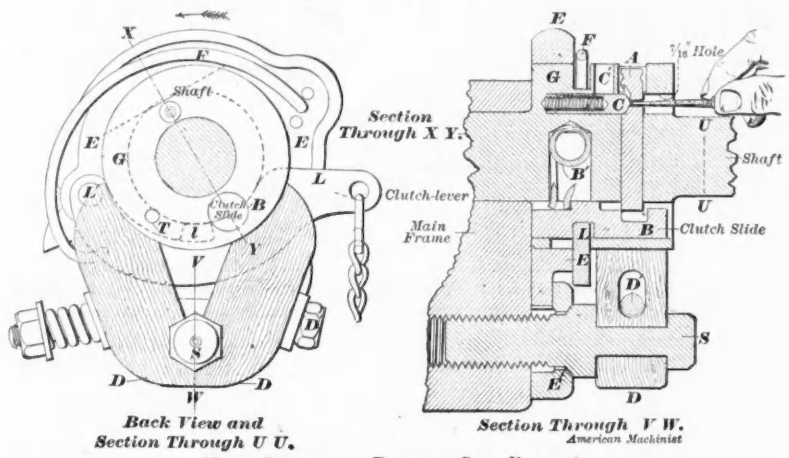


Fig. 1

through the tube, in the lower end of which it is made fast. To fill the cup, the cover is tilted over to one side, and as it cannot be removed it is never lost.

The crank-pin oiler has a glass body, protected by a perforated brass shell. There is a plunger fitting loosely in the stem of the cup; this plunger when down makes a seat by means of a shoulder near the bottom of the cup, and extends up into the cup to near the top. The plunger has a hole through it longitudinally, and its lift is regulated by means of an adjusting screw. When the engine is at work the plunger will be lifted and dropped by the motion, and the oil will pass in by the seat and down around the loosely fitting plunger, and oil thrown up by the motion of the cup will find its way down the central hole, thus giving two chances for feed. The adjustment of the feed is very easily made, and the cover is not removed for filling. Of course when the engine is standing the cup will not feed.



New Punching Press.—See Page 1.

The Ashcroft Mfg. Co. and the Consolidated Safety Valve Co., 111 Liberty street, New York, display their ordinary line of appliances very effectively, flanking steam gauges, clocks, counters, etc. against accident, by the Richardson pop safety valve.

With the Tabor indicator is shown a reducing motion, which, if it works as well as it looks as though it would, will be sure to find favor. A light worm-wheel, or rather ring, is located on the paper drum just above the part around which the cord ordinarily works; and a light frame is attached to the bottom of the arm on which the drum is mounted, taking the place of the piece that carries the leading pulley for the cord. In this frame is journaled a small multi-threaded coarse-pitch worm that engages with the worm-ring on the drum. The continuation of the piece on which the worm is cut, reduced in size, carries a spool to which the cord is led, the cord having the same motion as the cross-head in direction and extent—as from any convenient arm or piece fastened to the latter. Turning the worm revolves the paper drum; but as for each revolution of the worm the drum is advanced in revolution only a distance corresponding to the unit of pitch of the worm, it will be seen that the spool will be quite small in diameter, spools of different diameters being used for different piston strokes. There is a spring for keeping up lost motion between the worm and worm-ring, and a disengaging motion for stopping the paper drum, leaving the spool always in motion—no hooking up and unhooking. There is also an arrangement for almost instantly bringing the drum into proper position for getting the diagram in the center of the paper, lengthways. It makes a reducing motion that can be carried in the box without trouble, and at the same time the indicator may be used with any other form of reducing motion if desirable.

Fig. 2.

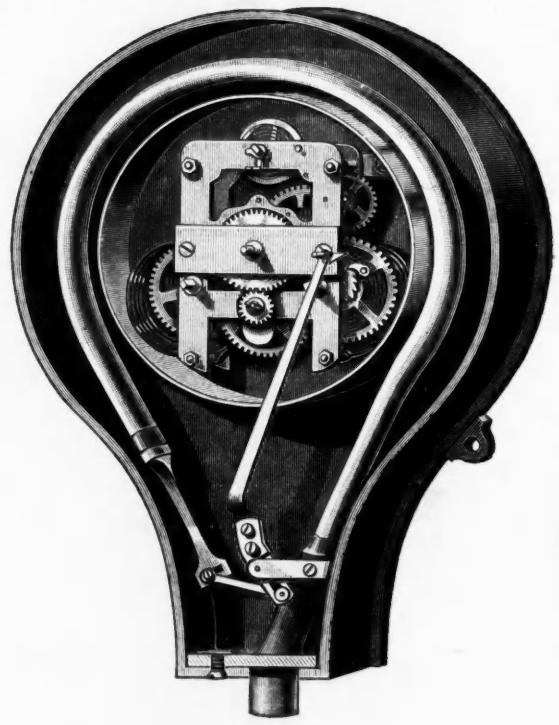


Fig. 3.

In an L of this exhibit space is that of the Hayden & Derby Mfg. Co., of 111 Liberty street, New York, consisting of Metropolitan automatic and double-tube injectors and H.-D. ejectors, with which our readers are familiar. One of each of the two types of injectors are cut away so as to expose to view the working parts, the fine finish of which is much admired.

Near by these exhibits is that of Schaeffer & Budenberg, 66 John street, N. Y., who show their usual line of goods in a fine display, including a large number of exhaust injectors and the Thompson and Straight Lyne indicators, both of their own make. They also show two new pressure recording gauges. One of them—the "Columbia"—is represented in Figs. 2 and 3. It is for steam, water, air or gas, and may be placed anywhere, either at the boiler or in the office. The circular lines indicate pressures and the radial lines time, the clock work requiring winding each twenty-four hours. The spring, as will be seen, is of the Bourdon type, and the lever mechanism is such as to avoid the use of toothed gearing.

The other is represented in Fig. 4, and is called the "Metropolitan." This is likewise for fluids and gases. It is an indicating as well as a recording gauge, the recording lever being fulcrumed quite independently of the indicating mechanism. The paper for recording the pressure is carried on a drum, as shown, the drum being 5 inches diameter, taking a sheet about 15 inches long and 3 inches wide. All bearings are on centers to reduce friction, and the whole is covered by a glass case.

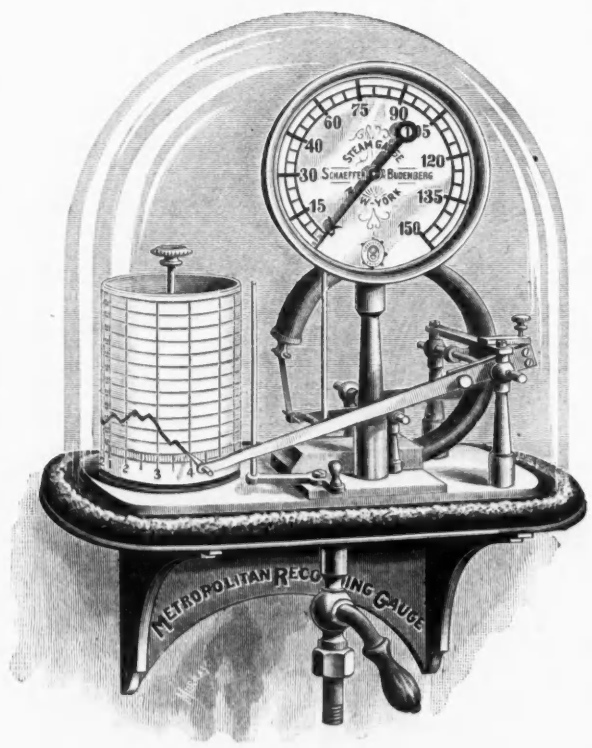


Fig. 4.

Next this is the Crosby Steam Gage and Valve Co., of Boston, with a display quite similar to those mentioned. A new feature of their exhibit as compared with previous ones is the Bosworth feed-water regulator, used in connection with the Bosworth pump governor. This is a device for maintaining automatically the desired height of water in a steam boiler. As exhibited, it looks rather formidable, but it is simply an arrangement whereby the difference in expansion between a brass pipe and an iron rod operates to set a steam pump in motion, or to stop it.

Of course, the Crosby indicator forms an important part of this exhibit.

J. E. Lonergan & Co., Philadelphia, Pa., are represented by their well-known oil cups, cylinder sight feed cups, pop safety valves, governors, injectors, steam traps, etc.; in the same space T. Kieley, of New York, is represented by his specialties, such as steam traps, pump governors, etc.

The Chapman Valve Manufacturing Co., of Indian Orchard, Mass., are represented by their usual line of goods, showing some recent improvements. Their standard flanges are now chased instead of being tapped, for the purpose of securing a more accurate thread. There are different kinds of flanges to suit different purposes, and I suppose in part to satisfy the inclinations of users. For plain packing there is a raised surface inside the bolt holes which I believe

is better than leaving the whole face flat. Other flanges are tongued and grooved, the packing being in the groove, which is good practice.

In some the flange is counter-bored in from the face, so that the pipe end can be pened or set out, and in some there is a projection of the hub beyond the common length, the extra projection being bored considerably larger than the pipe, leaving, when the flange is in place, an annular space into which a soft metal ring may be calked.

Their heavy valves show an improvement in the way of more metal better disposed to resist constantly increasing pressure, and the flanges are set out so that the nuts of the joint bolts can be come at without the customary "engineering" to that end, which is something for which those who have the joints to make will give them due credit.

The Lunkenheimer Company, Cincinnati, O., exhibit amongst other specialties in valves, oil cups, etc., the new "Lunken" gate valve, of which the cuts, Figs. 5, 6, 7 and 8, will show the construction. The bonnet, as will be seen, is held to its seat by means of a clip or yoke piece, which is a dropped steel forging, coppered to prevent rusting. The valve seat *C* can be removed and replaced by the use of a special wrench without removing the valve from its place. Fig. 7 shows the valve in section. The wedge *D*, which forces the valve to its seat in closing, is of horse shoe form. In all sizes of valves above 2½ inches there is a by-pass, as indicated at *N* in Fig. 8. This by pass is a passage leading from one side of the valve disk to the other, controlled by the end of the valve stem acting as a valve. There is sufficient lost motion to permit of the uncovering of this passage, in turning the wheel to open the valve before moving the valve much, if any. This uncovering permits steam to pass from the inlet to the outlet side of the valve, the intention being to place the valve disk in equilibrium before it is opened, thus preserving both seat and valve from undue wear. The valve is comparatively short and compact, making it practicable to get ample strength without excessive weight.

The most noticeable display of Shutte & Goering, of Philadelphia, Pa., is an exhaust steam induction condenser of rather heroic proportions. As it stands in their space it is necessary to climb twenty stairs to reach the top. It is for a 20-inch exhaust pipe and at 20 pounds of steam per horse power per hour is rated at 2,000 horse-power. This firm also exhibit the Korting injector and other of their specialties.

The Hancock Inspirator Co., of Boston, Mass., exhibit inspirators and ejectors, their "display piece" being an arrangement of inspirators handling water as in actual service. Mr. Charles E. Randall, in charge of the exhibit, handles two of these for locomotive use very skillfully, or rather effectively for they are very simply operated, and locomotive engineers, of whom a good many stop to see them work, put them through the paces very readily. The certainty with which they will start and keep on working with the steam throttled to anywhere between 30 pounds and the limit, and their taking right hold after blowing back till they are thoroughly heated, lifting hot water from the little hot tank, seems to be a convincing argument with engineers.

The Nathan Manufacturing Co., of New York, show a fine line of oil cups and oilers, some of them large enough to affect the visible oil supply at once filling. They also, amongst other well-known goods, show the monitor and re-starting injectors, and the new Nathan. This last-named instrument is for locomotive service, and being non-lifting must be placed lower than the tank, but by a special arrangement the overflow may be carried up anywhere convenient to the engineer. These injectors are shown cut away so as to permit the working parts to be seen. H.

Making a Cast Chain.

By I. Whitehead.

I had occasion to make a pattern for a Tobin bronze chain, as it was required to stand the action of the salt water constantly, in which wrought iron or steel would corrode very rapidly, and thinking that other conditions might call for cast chains in other metals as well, it would be profitable to many of the readers of the American Machinist to learn of a successful plan.

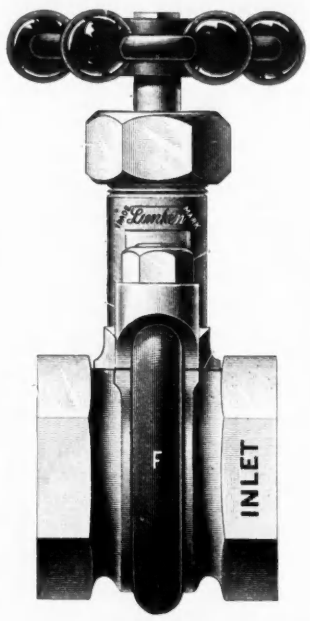


Fig. 5.

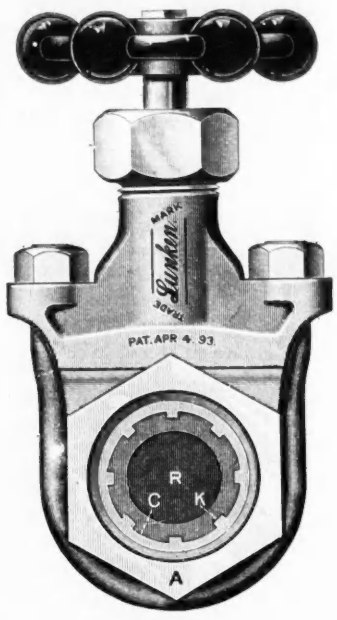


Fig. 6.

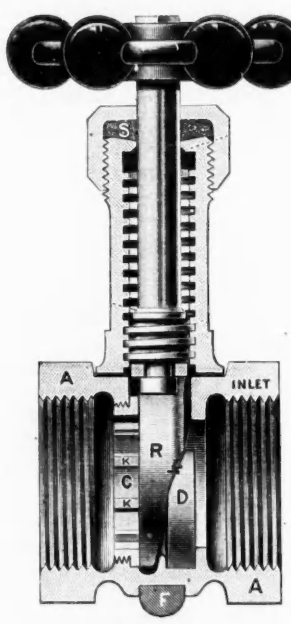


Fig. 7.

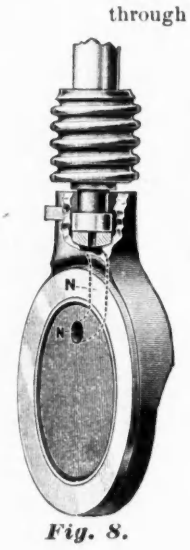


Fig. 8.

First was made a pattern of one of the links as shown in Fig. 2. This was made by simply turning a half ring on a face-plate as shown in Fig. 3, which cut in two will form one end of the link and do the same for the other end, while the intervening straight parts are turned in halves between centers. The joints were put together with glue on paper. When dry the paper strengthens the joints so that you can run one or two saw cuts, as shown in Fig. 2 at *a a* and *b b*, to a suitable depth into which thin strips may be fitted and glued, thus making a cheap strong joint. With this pattern we cast a number of links which, of course, are separate from each other. These we will use for every other link in our chain by placing them in a core which will make the connecting link as follows:

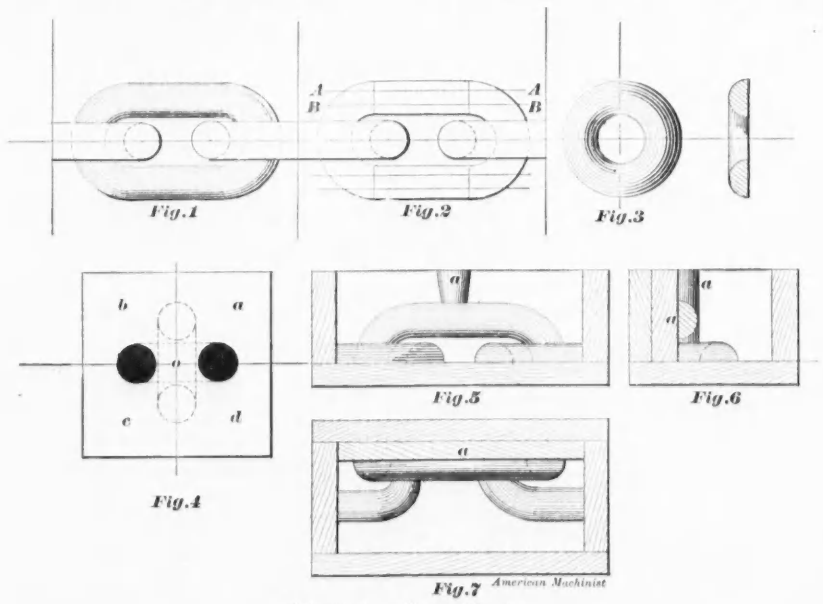
Fig. 4 shows an end view of the core when put together. It will appear evident from this view that each quarter as shown in *a*, *b*, *c* and *d* are exactly similar in form to each other, and therefore one core box for *a* will be all that will be required to make the four cores to form a complete link.

Fig. 5 is core box in elevation with the front side off, showing the half round link as it is fixed to the bottom of the box as well as on the side, while Fig. 6 is a section through the center, and Fig. 7 is a plan of the same. At *a* in Figs. 6 and 7 is shown a loose side piece on which the link form is fastened, so that when the core is made and drawn out of the box the side form leaves with the core and is drawn out of the side without damage. This is essential as there is only about ⅛″ of sand at one point between the links. I arranged the space for my cast link to pass through the core in the strongest manner by dividing the sand equally so that the thinnest point may be made leaving only $\frac{1}{10}$″ sand and not break through.

The link form inside the box is made up of turned pieces like Fig. 3, but the link which runs outside the ends of the core should be made a little larger to allow the link casting to set in the space. By pasting the two cores *a* and *b* together, and also *c* and *d*, we shall have a complete link in two halves.

Now we may bed the half core *c d* to the number of links we wish to cast at one time and then place in our cast links connecting the cores together. The top core *a b* may now be put on taking care that it matches on its sides perfectly. In the core box at *a* for the top half I formed a running gate for each link. Where the link joins at *o*, Fig. 4, it would be better to slightly enlarge it at joint where possible as it can easily be dressed off the casting on emery wheel and so insure greater strength, as with the greatest care slight imperfections may occur.

It will be evident that the core box might be lengthened to contain any number of links in one box, and also made that instead of setting in every other space a cast link, all might be cast at one time. In that case it would be more work for the pattern maker and less for the molder. If there were any defective castings they could be replaced by the single core described. An elliptical or flattened link could be made if greater strength was required.



Making a Cast Chain.

Biology in Machine Design.

By W. H. Booth.

"Chip's" letter on machine supports is rather welcome to me because I have for a long time felt that my views on the subject savor of heresy. An American friend who knows infinitely more of machine tools than I do was pointing out to me one day certain details in some American tools which he considered to be superior to points illustrated in the catalogue of an English tool maker. On a good many of these points I think he was perfectly right, but I have never felt satisfied that he was right in upholding the curved spindly article, which does duty as a leg in an American lathe, as superior to the English lathe support he condemned and which resembled somewhat "Chip's" Fig. 2 with a wide spreading column base. I have tried to think that the curved leg was correct but it appeals to neither my sense of shape or fitness. People who have drawing-rooms upholstered in blue silk are apt to have chairs with similar shaped supports, especially if they are new at the house-keeping business, and one sinks very slowly upon such chairs. This betrays one's feelings as to their strength, and I never see the curved lathe leg without asking myself if it has some function to perform other than to support a direct load, and wondering how it would do to similarly curve the end post of a bridge truss. I can understand the leg being inclined because inclination spreads the base and diminishes a tendency to rock, and the piers of a viaduct or trestle bridge are thus spread at the base, but still each member of the pier is supposed to be placed symmetrically round a straight line not round a curve.

Seeing the leg curved and being authoritatively informed that that is good design, are we not bound to believe that if this be so then good design demands that the connection between the lathe and the ground should be as limber as possible? By having a limber connection the lathe would, so to speak, all go together without any constraint from the floor, the floor being used as a support merely because of the inability of the lathe to float in mid-air.

If this conclusion be correct we very readily pass on to a further stage and are driven in fact to suspend our tools from the ceiling by ropes, chains or rods, thereby rendering them entirely self-contained and free to move. The anvil principle is of use in a tool in that there is a mass of metal to absorb vibration and kill it. Is it not likely that the lack of a rigid foundation would tend to the same end. I have heard of cases of vibration, the details of which I cannot recall, where vibration was stopped by nearly cutting through some piece which seemed to act as a transmitter. The very slight bit left by the cut was unable to transmit the vibrations through from side to side of the cut, and a cure was effected. Now given a good stiff lathe bed carrying its head-stock and saddle, is it not possible that this is sufficient in itself as a tool for turning purposes without support from the floor, and that such support, merely necessary to hold the bed at a convenient elevation for the workman, requires to be light and limber, or otherwise the floor will react as a sounding board and keep up a continued vibration? I confess that I look with quite an open mind on this, but unless the above

explanation be right I should hesitate to commend the light curved lathe leg as good practice.

Concerning vibration and perhaps closely connected with the question of machine supports I would cite some personal experience. I know a shop where they went to a very great expense in constructing two vertical boring mills for boring out large steam engine cylinders. These mills formed part of the building itself. They had first a heavy cast-iron base plate fitted with suitable arrangements for holding the cylinders to be bored, and the mill itself was like a high three-sided room built upon this base plate in heavy masonry much as though the mason had been employed building London Bridge and could not shake off the habit. Then there were heavy boring bars carried in top and bottom bearings of large diameter with full length feed screw let into a longitudinal slot and carrying at top a nest of gears. It was all of the best and had a customer come to complain that his cylinder was not well bored it would have been enough to show him these mills and point out that everything possible had been done to secure success, and he would have at once perceived that better work could only be hoped for, never accomplished, and gone away satisfied. But work was too plentiful to allow all cylinders to be bored in these A1 mills, and they had to take their chance on the shop floor. There, supported on a pair of baulks, a light boring bar was put through them and run in bearings carried on a light girder bolted across each end of the cylinder and carrying an ordinary boring head, and the bar was rotated from any convenient shaft by a belt, and I think a worm-wheel to reduce speed. With this rough and ready apparatus the cylinders were better finished than they ever were in the big mills, and neither did they ring during the operations like so many bells as did those firmly held in the mills.

When work chatters it may not always be because there is a lack of the anvil principle, but because there is too much rigidity, too much resonance. And I am led to think it possible that where the anvil principle is applied it must be as close as possible to the tool, as in the bed of a lathe, and not away off in a leg support. The question is, did the light lathe leg grow out of any actual experience that such lathes did better work?

Further thought seems to tell us that it by no means holds true that a good support for a steam engine is necessarily good for a machine tool. The steam engine wants a good solid foundation because it is moved by a succession of impulses whereas the lathe or drill has no such uneven action, or when it has is not running at a high speed, and it may be that no very stiff support is required. It may sometimes be noticed that a clock of feeble going powers will go when standing on a stone or wooden shelf, but will refuse to go if a piece of cloth be interposed. The more solid base has some effect in keeping the clock in motion, and I have attributed this to the fact that the solid shelf maintained the whole in a state of vibration and so diminished the friction, it being well recognized that friction is more or less eliminated by vibration, a fact which may be supposed to be of some value in allowing the members of a bridge to turn upon their end pins so as to place themselves into line with the direction of the primary stress in them, thus avoiding the secondary stresses which some engineers have thought worth more consideration than is often given to them.

I am inclined to think that certain work would be better accomplished in a lathe were a thick felt pad interposed between the bed and the floor supports in order to check vibration and reaction.

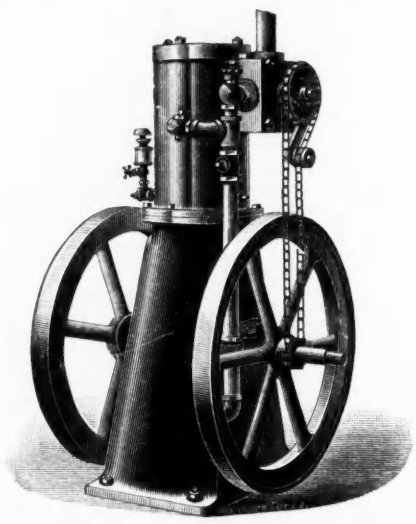
"I presume, my good fellow, you are a laborer?" said a lawyer to a plainly dressed witness. "You are right; I am a workman, sir," replied the witness, who was a civil engineer. "Familiar with the use of pick, shovel and spade, I presume?" "To some extent. Those are not the principal implements of my trade, though." "Perhaps you will condescend to enlighten me as to your principal implements?" "It is hardly worth while. You don't understand their nature or use" "Probably not," loftily, "but I insist on knowing what they are." "Brains."—*Bradford Daily Argus.*

A New Vapor Engine.

The accompanying illustration is of a new engine designed to use gas, or the vapor of gasoline, and called the "Safety Vapor Engine."

Its distinguishing feature may be said to be its simplicity of construction, the functions of admission, firing and exhaust being performed by a single continuously rotating slide-valve which works upon a plain raised seat and is thoroughly lubricated by automatic devices.

The engine, as usual in machines of this character, has an inverted cylinder with



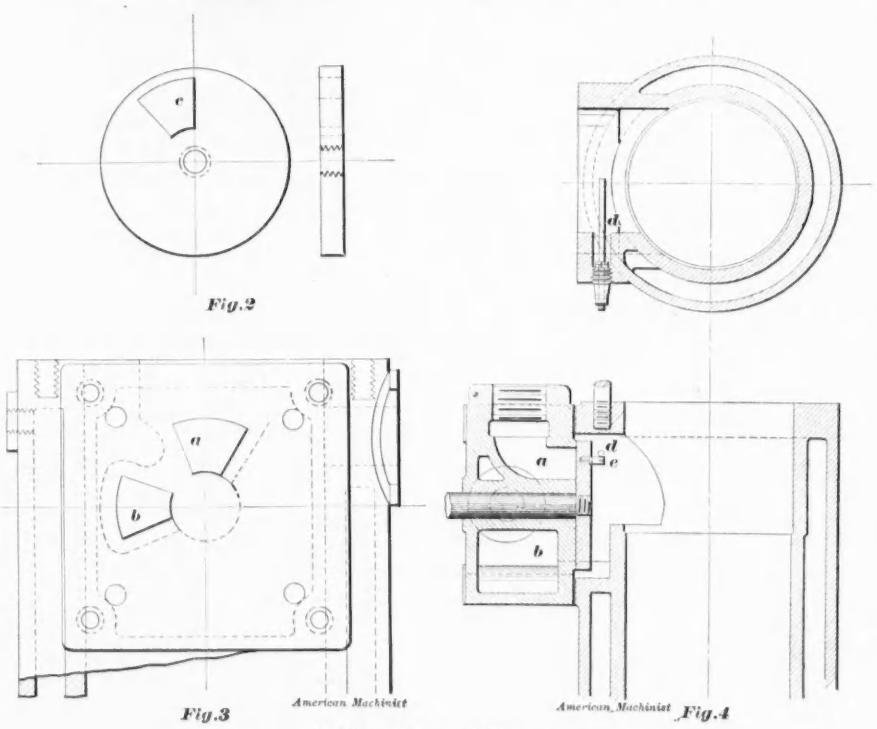


Fig.2 *Fig.3* *Fig.4*

A New Vapor Engine.

trunk piston to which the connecting rod is directly attached. An explosion of gas occurs at every alternate downward movement of the piston, the following return stroke expelling the gases of combustion, the next downward stroke drawing in the charge, which is then compressed by the next upward stroke ready for another explosion.

An idea of the general appearance of the engine may be had from the perspective engraving, and the valve action may be understood from the outline engravings.

The valve is a plain cast-iron disk, Fig. 2, having one port passing straight through it as shown.

This valve, instead of being within the chest, is below it, and rests upon a seat which forms the bottom of the chest, the pressure within the cylinder thus tending to seat the valve, which is driven at half the speed of the engine, by sprocket wheels and a steel chain.

Fig. 3 will give an idea of the arrangement of the exhaust and admission ports, this being a side view of the upper part of the cylinder, the valve being supposed to be behind the seat in this view and rotating from right to left or "counter-clockwise." The upper port *a* is the exhaust port and *b* the inlet port.

Now supposing the piston to have reached its lowest point during a working stroke, the port *c* in the valve has then opened 20 per cent. of the area of the exhaust port *a*, and by the upward movement of the piston the cylinder is swept clear, the exhaust port being closed and the inlet port *b* opened just as the next downward stroke begins. At the end of this downward stroke the inlet port *b* is closed, and the valve port *c* then commences to travel over the blank space from *b* to *a*, during which the compression of the charge and its explosion take place.

The engine does not govern by cutting off the supply of gas, but by regulating the amount admitted, this being accomplished by an ordinary throttling governor.

The firing of the charge is accomplished by this same valve in a manner which will be readily understood by reference to Fig. 4, in which the exhaust and inlet passages through the chest are designated by the same letters as the corresponding ports in Fig. 3. In the vertical section of Fig. 4 the valve and stem are shown in place, and *d* is an electrode which is simply a very hard piece of steel wire supported as indicated in the horizontal section above and connected with a battery. Inserted in the inner face of the valve is a small stud *e* which makes contact with the electrode *d* about $\frac{5}{16}''$ from the end of the latter and wiping under it as shown produces a spark at the moment of separation which fires the charge.

Both the cylinder and chest are water-jacketed as shown. Oil is fed to the valve face at a point near the stem and is distributed over the face, the lubrication of this valve being found by experience to be thorough and efficient. Pressure exerted upon the working side of the chain when the engine is running, and tending to deflect the chain, shows that the valve moves easily, a fact which is further shown by the fact that excessive wear does not take place.

Special attention is paid to the piston packing, this consisting of three cast-iron rings, which are cut and sprung together to give the required tension while they are turned to fit the cylinder, the chuck in which they are held being eccentric to give the required variation in thickness. The connecting rod is a steel casting bushed with plain split brass bushings, provision being made for taking up wear.

The engine is at present made in four sizes—$\frac{1}{2}$, 1, 2 and 4 H. P. by the Safety Vapor Engine Co., 16 Murray street, New York.

Death of Alexander K. Rider.

In these rapid times, those who have lived and done good work among us are all too soon forgotten when they rest finally from their labors. In the hope that the memory of a good man, and a more than ordinarily skillful mechanic and inventor, well known in his time to many of the older engineers and mechanics now living, may be kept green a little longer than might otherwise be the case, these lines are written.

Mr. Alexander K. Rider, who died at his home in Walden, N. Y., September 13, 1893, was born January 8, 1821, and came to this country when a mere boy, from England, his sole capital being pluck and brains. His father, Joe Rider, was a skillful mechanic, one of his feats of construction being a clock supplied with motive power by the rise and fall of a mercury column under variations of atmospheric pressure, and which, when started, ran ten years in the British Museum without further attention. On his arrival in this country, the boy found employment as a core maker in the Phœnix Foundry in New York City (James Cunningham, proprietor). Here young Rider soon proved that he was made of the right metal, and he rose rapidly to the position of foreman, and from that to superintendent of the works. In this establishment at that time were two other boys, Peter Hogg and Cornelius H. Delamater, who afterwards became the founders of the once famous Delamater Iron Works at the foot of Thirteenth street in New York City. C. H. Delamater was a timekeeper in the Phœnix Foundry, and Peter Hogg, a relative of Delamater, was a mechanic in the shop. When, subsequently, Messrs. Hogg and Delamater started their foundry and machine shop, the nucleus of the Delamater Iron Works, Mr. Rider became their superintendent, devoting most of his time to the foundry. In 1854, he started in business for himself in a foundry and machine shop at the foot of Fifty ninth street, New York (then called Bloomingdale), and in these works he received a physical injury, the effect of which lasted through his life. In breaking up an old gun for remelting, a fragment struck him with such violence that Dr. Willard Parker, Sr. (one of the most eminent surgeons of his day), advised Mr. Rider that he could not probably survive more than twenty-four hours. Yet, in this desperate state, will-power and courage so far assisted remedial measures that he rallied, and, though never again robust, he outlived by many years the able physician who attended him.

In 1855, Mr. Hogg secured for Mr. Rider a position as superintendent of a slate quarry in Vermont, which he successfully managed for several years. During this period, he still found time to devote to his favorite studies, and here he invented a direct acting steam pump, thus becoming one of the pioneers in this field of invention, but never, before this notice, having received due credit for it. Before going to Vermont, and while Mr. Rider was still with Hogg and Delamater, the screw propeller became generally recognized as the coming device for the propulsion of vessels in deep water. Mr. Rider perfected the method of sweeping molds for propellers in loam, and also of casting small propellers in green sand. These methods are still in use, and many thousands of propellers have been produced by them. Later he invented the "Rider variable cut off valve gear" for steam engines, and also the widely known "Rider hot air pumping engine," of which thousands were manufactured and sold at the Delamater Iron Works.

His later and declining years were passed in retirement at his residence in Walden, N. Y., where he occupied his time in reading, of which he was very fond, and in mechanical construction in his private workshop, where he produced some exceedingly fine specimens of handicraft.

The few people of high intelligence whom Mr. Rider admitted to close intimacy found in him a warm friend and agreeable companion, possessed not only of brilliant in-

ventive talent and great constructive ability, but of keen perception and analytical mind, which enabled him to form sound and critical conclusions upon a wide range of mechanical, scientific and metaphysical questions. Holding advanced views on all subjects, his acceptance of no particular religious creed led many to misinterpret him. A believer in a ruling and presiding Deity, and in the Bible, properly interpreted, as a revelation of divine agency in creation, and of the true relations of man to the Creator, he also saw in the natural order of things an equally authoritative and parallel revelation, and held that these two sources of truth were infallible guides to human action.

Thus has passed away in ripe age a man who has left a record of faithful, honest and successful work, and who saw not only the beginning of many important innovations, but who was himself an active factor in the great material progress of the age.

LEICESTER ALLEN.

Lathe Center Grinder.

The latest device for turning lathe centers that has come to our notice is the one illustrated herewith. It consists of a steel frame, with a shank to secure it in the tool post of the lathe, a driving shaft carrying a paper friction wheel, and on one end a leather friction wheel which is driven by the face-plate of the lathe, and a bar upon which slides the sleeve carrying the emery wheel.

To operate, the machine is placed in the tool post at the required angle, the leather friction wheel brought into contact with the face-plate, and the emery wheel moved back and forth across the center by hand.

In the hands of a mechanic, the slots in the face-plate do not affect the work done, as the contact necessary to drive the device is very slight; however, in some cases a special smooth plate is advisable. This machine is made by Samuel C. Rogers & Co., Buffalo, N. Y.

Development of a Curved Surface—A Practical Problem.

By PROF. FREDERIC R. HONEY.

The general problem *to develop the surface of any oblique cylinder* is solved by descriptive geometry.

There is, however, a special case which frequently occurs in practice, the construction of which may be understood by one who is conversant only with the elements of mechanical drawing.

I will give the problem in the way in which it has recently been presented to me by a business man who asked for a simple construction which would be available in the workshop.

It is required to find the outline in the flat of a piece of sheet brass, which, when bent, will assume the form shown in the accompanying illustrations:

Fig. 1 is a front view or elevation of a fireplace hood. Fig. 2 is a side view or elevation looking in the direction of the arrow a. Fig. 3 is the plan or view looking in the direction of the arrow b.

The constructions of the elevations and plan are illustrated in Figs. 4, 5 and 6.

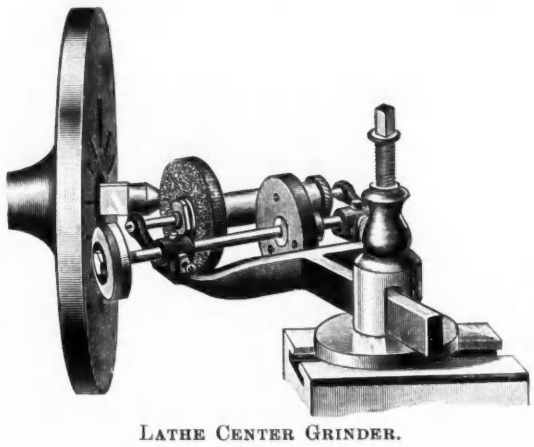
The curve $a'\ b'\ c'$, Fig. 4 (in this case an arc of a circle), is given. The triangle $b_1\ b_{11}\ c_{11}$, Fig. 5, is also given, $b_1\ c_{11}$ being made equal to $b'\ c_1$, Fig. 4, the point b_{11} projecting any assigned distance from $b_1\ c_{11}$.

In order to construct the curve $a'\ b''\ c'$, Fig. 4, divide the arc $a'\ b'\ c'$ into any convenient number of equal parts. Since all the work is symmetrical with respect to the center line $b'\ 1$, only one half of the construction is shown. One half of the arc $b'\ c'$ is divided into four equal parts at the points d', e' and f'. Draw $d'\ 2$, $e'\ 3$ and $f'\ 4$ parallel to $b'\ 1$. Draw $d'\ d_1$, $e'\ e_1$ and $f'\ f_1$ parallel to $a'\ c'$, intersecting $b_1\ c_{11}$, Fig. 5, at d_1, e_1 and f_1. Draw $d_1\ d_{11}$, $e_1\ e_{11}$ and $f_1\ f_{11}$ parallel to $b_1\ b_{11}$, intersecting $b_{11}\ c_{11}$ at d_{11}, e_{11} and f_{11}. From these points draw $b_{11}\ b''$, $d_{11}\ d''$, $e_{11}\ e''$ and $f_{11}\ f''$ parallel to $a'\ c'\ c''$, intersecting $b'\ 1$, $d'\ 2$, $e'\ 3$ and $f'\ 4$ at b'', d'', e'' and f''; $b''\ d''\ e''\ f''\ c'$ drawn through these points is one-half of the required curve $a'\ b''\ c'$.

The part $a'\ b''$ is obtained in the same way.

The front elevation of the hood is $a'\ b'\ c'\ b''$.

The plan, Fig. 6, is drawn as follows:



LATHE CENTER GRINDER.

Draw $a\ c$ parallel and equal to $a'\ c'$. The broken lines $b\ b$, $d\ d$, $e\ e$ and $f\ f$ are prolongations of the corresponding lines Fig. 4.

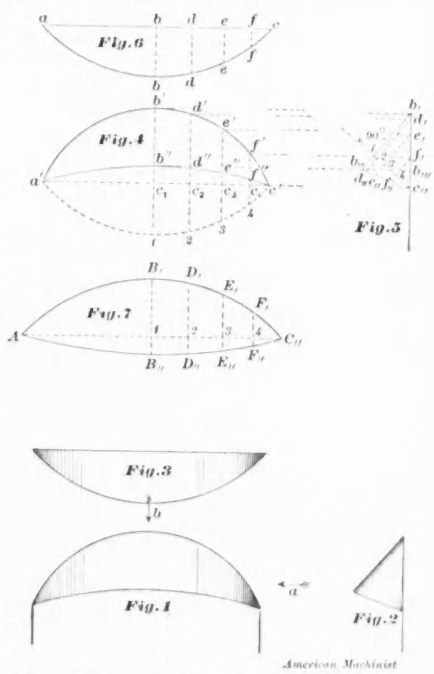
The length of $b\ b$ is made equal to $b_{11}\ b_{111}$, the distance from b_{11} to the line $b_1\ c_{111}$, Fig. 5. Similarly the lengths of the lines $d\ d$, $e\ e$ and $f\ f$ are respectively equal to the distances from the points d_{11}, e_{11} and f_{11} to the line $b_1\ c_{111}$.

The curve traced through the points thus found gives one-half of the outline $b\ d\ e\ f\ c$. The remaining half $a\ b$ is determined by a similar construction, *i. e.*, the parts $a\ b$ and $b\ c$ are symmetrical with respect to the axis $b\ b$.

THE CONSTRUCTION OF THE ENVELOPE.

In order to construct the envelope, Fig. 7, draw $c_{11}\ 1$, Fig. 5, perpendicular to $b_1\ b_{11}$ intersecting $b_1\ b_{111}$, $d_1\ d_{111}$, $e_1\ e_{111}$ and $f_1\ f_{111}$ at 1, 2, 3 and 4. Lay off, Fig. 4, $c_1\ 1$, $c_2\ 2$, $c_3\ 3$ and $c_4\ 4$ respectively equal to $c_{11}\ 1$, $c_{11}\ 2$, $c_{11}\ 3$ and $c_{11}\ 4$, Fig. 5. The line traced through the points 1, 2, 3, 4 and c' is one-half of the curve of right section. The remaining half $a'\ 1$ is determined in the same manner.

Lay off the true length of this curve on the straight line $A\ C_{111}$, Fig. 7. If very great accuracy is desired the construction



DEVELOPMENT OF A CURVED SURFACE.

explained in a previous article may be employed;* but for all practical purposes the following is sufficiently accurate: Lay off, Fig. 7, $1-2$, $2-3$, $3-4$ and $4-C_{111}$, respectively, to $1-2$, $2-3$, $3-4$ and $4-c'$, the corresponding parts of the curve Fig. 4. Through 1, 2, 3 and 4 draw $B_1\ B_{11}$, $D_1\ D_{11}$, $E_1\ E_{11}$ and $F_1\ F_{11}$ perpendicular to $A\ C_{111}$. Lay off $1\ B_{11}$, $2\ D_{11}$, $3\ E_1$ and $4\ F_1$ equal to the corresponding measurements $1\ b_1$, $2\ d_1$, $3\ e_1$ and $4\ f_1$, Fig. 5. Also lay off $1\ B_{111}$, $2\ D_{111}$, $3\ E_{11}$ and $4\ F_{11}$, respectively, equal to $1\ b_{111}$, $2\ d_{111}$, $3\ e_{111}$ and $4\ f_{111}$, the corresponding measurements in Fig. 5.

* "*The Measurement of Curved Lines*," AMERICAN MACHINIST, June 9th, 1892.

$B_1\ C_{11}\ B_{11}$ is one-half of the envelope. The other half $B_1\ A\ B_{11}$ is obtained in the same manner, the two parts being symmetrical with respect to the axis $B_1\ B_{11}$. In order to avoid confusion of lines I have divided the arc $a'\ b'\ c'$, Fig. 4, into a small number of parts. The number into which it is desirable to divide it depends upon the size of the figure and the degree of accuracy sought.

If the arcs $b'\ d'$, $d'\ e'$, $e'\ f'$ and $f'\ c'$ are equal, it is evident that the corresponding parts in the envelope, viz., $B_1\ D_1$, $D_1\ E_1$, $E_1\ F_1$ and $F_1\ C_{11}$ should be equal.

The length of the curve $A_1\ B_1\ C_{11}$ should be equal to that of the arc $a'\ b'\ c'$.

The true form of the curve whose front elevation is $a'\ b''\ c'$, Fig. 4, whose side elevation is the straight line $b_{11}\ c_{11}$, Fig. 5, and whose plan is $a\ b\ c$, Fig. 6, may be easily found. Its length should be equal to that of the curve $A\ B_{11}\ C_{11}$, Fig. 7. Its determination is not however essential in the construction of this problem.

LETTERS FROM PRACTICAL MEN.

Hydraulic Jacks at the Launching of the "Great Eastern."

Editor American Machinist:

My attention has been called to a question in the article by W. H. Booth in yours of August 24th, which implies a doubt as to the correctness of my statement that there were two hydraulic jacks employed to start the movement of the "Great Eastern" at the first attempt to launch that huge vessel. I have therefore consulted several English authorities, and find that my information, as given in the article of July 13th, is fully corroborated.

In a letter to the Directors of the Eastern Steam Navigation Company, October 23, 1857, Mr. Brunel, in speaking of the method of launching, says: "As regards the nature of the operation, it has frequently been stated, but it seems necessary to repeat it, that the ship will not be 'launched' in the ordinary sense of the term, but merely lowered or drawn down to low water mark, to be thence floated off by a slow and laborious operation, requiring two, and possibly three tides, and very probably effected partly in the night, and at no time offering any particularly interesting spectacle, or even the excitement of risk, as I am happy to feel that, even assuming accidents to occur or miscalculations to have been made rendering the operation unsuccessful, the ship may stop half way down, or not move at all, more power or other remedies may have to be applied, but no injury to the ship can result from any failure in the course of proceeding in this mode of launching."

If Mr. Brunel calmly contemplated (as he appears by his letter to have done) the possibility that the vessel might "not move at all," it is not probable that he would have neglected to provide some effective means to start it moving. That he did this appears from the following: On November 7, 1857, (four days after the first attempt to launch) a correspondent of *The Engineer* (page 362, Vol. 4) says: "Well, two good rams butt very well, but a dozen will do better."

On November 17, 1857, a "Civil Engineer" writing (*The Engineer*, page 417, Vol. 4) says: "If hydraulic presses were used to start the vessel, why could they not have been used for the entire operation of propelling her down the incline into the water?" An editorial note in *The Engineer*, of Friday, November 6th, (page 345, Vol 4) describing the attempt to launch the vessel three days before, says the vessel was "urged on not only by its own momentum, but also by the pull of the down haul tackle, said to equal 600 tons, as well as by the propelling force of the two hydraulic rams, said to be 1,600 tons more." In the *Times* of November 4, 1857, in describing the unsuccessful attempt to launch the "Great Eastern" the day before, the reporter says: "Between each drum and the cradle, on which the vessel rested, was fixed a hydraulic ram to 'start' her. That at the forward end gave a pressure of 600 tons and that at the stern 1,000."

The foregoing statements are believed to be sufficient to prove that Mr. Booth's "friend who ought to know," has "left undone that which he ought to have done, and there is no health in him," so far as an accurate knowledge of what was actually done at the first attempt to launch the "Great Eastern" is concerned.

It may be of interest to add a brief account of the environment of the great ship during the subsequent attempts to get her into the water, each of which were emphasized by burst hydraulic jacks, broken timbers, and ruptured chain cables. After the ship had progressed but one-third of the distance it had to traverse, the editor of *The Engineer* (page 460, Vol. 4) says: "Indeed the present state of things in the Millwall shipyard reminds us very much of what would be the case after a week's frolic of a cow in a crockery shop. We are hardly exaggerating matters when we say there is scarcely a whole thing in the place, whether it be of cast or wrought-iron, or wood. Everything has been made to do duty until it could stand no longer, and each thing has nobly vied with everything else in trying to get through each successive day without being doubled up. We are quite sure that in the whole history of engineering no record could be found of materials having stood such a course of physicking as those employed in the launch of the 'Leviathan.'"

The obvious moral from which is: "Get ready to do whatever is to be done before attempting to do it." W. F. DURFEE.

West New Brighton, N. Y., September 19, 1893.

Gear Teeth.

Editor American Machinist:

I have for some time wanted to have a finger in the gear pie that has been served up in your columns, but have waited in the hope that some one might possibly explain the whole matter to every one's satisfaction; this, however, not having been done, I will (with your permission) speak my little piece.

I must take exception to Mr. Grant's statements in your issue of June 1st, that "a handy rule, like many in common use, was impossible if we retain a decent respect for accuracy." "All these rules endeavor to find a center for the circle approximating to the true tooth curve, and to locate it by some easily remembered rule that is independent of the number of teeth in the gear, while it is easily proved that the true location of that center is not thus independent." I would like to ask Mr. Grant if the "true tooth curve" has been determined, and if so, what it is, and by whom was it determined? And would also like to see the proof that the center of the tooth curve is dependent on the number of teeth in the gear.

I will give a simple rule, one that is easily remembered, and which has no connection with the number of teeth in the gear, and which hits so "near the mark as to accuracy" that it has been used for over 25 years on some of the best specimens of gear work in use in the country. My earliest use of it (personally) was about 16 years ago, and was with a pinion of 12 teeth driving a rack located above the pinion. The circular pitch was about $1\frac{1}{32}''$ or, to be exact, $1.0392''$, face $3''$, rack and pinion both cut, and there was no apparent tendency of the pinion to lift the rack. Since that time I have used the same rule for all kinds of work, gears, external and internal, rack and pinions of all sizes and pitches, from mortise gears of 10 feet diameter to pinions of less than one inch diameter. But as Mr. Grant wants proof "not by declaring that it has given entire satisfaction, but by actually drawing several examples," the examples are inclosed, and are what Mr. Grant asks for, viz., a pinion of 12 teeth in various positions with another pinion of 12 teeth, and also with a rack; to these I have added a pinion of 12 teeth

meshing with an internal gear of 24 teeth, and the same pinion meshing with an internal gear of 44 teeth. These are all drawn by the same rule, and all are capable of being cut by a rotating cutter.

I do not wish to be understood as claiming to have originated this rule, and while many may know of and use it, I have never heard of it, neither have I ever seen it in any publication; I know of but one other than myself that knows of or uses it. The form of the teeth is of the double curve variety, and the rule is (roughly stated for the purpose of memorizing): half the pitch for the face radius, three quarters of the pitch for the flank radius, chord pitch being understood in both cases. That this is not exactly true as regards the flank radius, will be seen by an inspection of Fig. 2, which shows the construction. Whether circular or chordal pitch is used for obtaining the diameter, I always use for the addendum three-tenths of the pitch, and for the whole depth of the tooth seven tenths of the pitch. This is, of course, immaterial; the radius for the face of the tooth is exactly one-half the chord pitch. This face curve is struck from *a*, Fig. 2, as a center, and is continued below the pitch line (in the case of external gears) indefinitely. The radius for the flank of the tooth is struck from *b* as a center, *b* being located in the exact center of the next adjoining tooth, and with a radius sufficient to produce an arc that shall be tangential to the face arc, the flank curve of the tooth is produced; this radius is not exactly three-quarters of the pitch, as previously stated. I neglected to state that the centers of the arcs for both face and flank curves of teeth are located on the pitch line in every case.

The number of teeth in the gear does not enter into the matter in any way, and it will be seen from the drawing that a pinion of 12 teeth has unusual strength. In my opinion, Mr. Grant's broad statement that "teeth of different numbers cannot be properly drawn by the use of a single fixed rule" is entirely wrong.

The drawing accompanying Mr. Calvert's communication in issue of June 29th recalls to my mind a treatise on gearing, published by a prominent manufacturing establishment, not many years ago; after an exhaustive explanation of their theory, and a beautifully illustrated description of the special machinery employed in producing the gear cutters offered to the public, they close with a chapter on the "theoretical defects of this system." Mr. Calvert's drawing illustrates the "theoretical defects" much better than the pages given to it in the treatise did, the defect being the abrupt change from one curve to another, causing a corner or hump at the pitch line. The pinions shown might run very nicely for a long time, if they had nothing to do, but give them a little labor and how long would they last, to say nothing of the racket they would kick up.

That cutters made on the system described may be formed by comparatively simple and inexpensive machinery is a point well worth considering. I have in mind a case in which special cutters were made for every gear having different numbers of teeth, this, however, is a useless refinement for even the finest work.

Before closing, I wish to ask "Easy Way" if he would construct a cam face to act on a point, and afterward put a roller in place of said point. This question is prompted by Fig. 2 of his article in the American Machinist of June 29th., which leads me to believe that he would do so. If he says exactly what he means in that article, he is not competent to criticise either Mr. Smith or any one else in the line of cam work, his "abundant practice" to the contrary, notwithstanding. Mr. Smith is correct in advising a large roller for any work, that is as large to a reasonable extent as the construction will admit of, and if he had supplemented this with, that the roller stud should be of as small a diameter as the nature of the work would allow, he would have covered the ground completely and correctly.

Who is "Easy Way" anyway?

To go back to the subject of gears, I want to call attention to a point that is often overlooked, and seldom if ever mentioned in works on gearing, viz., that the pitch of a rack should be equal to the circular pitch

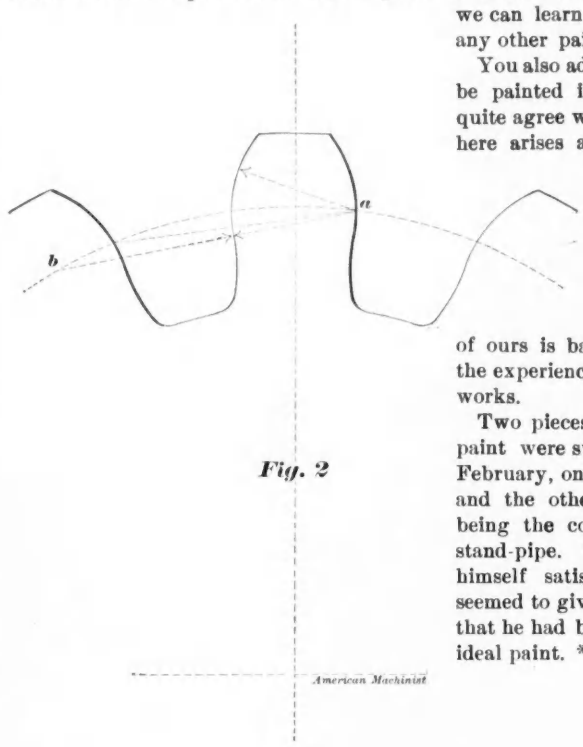


Fig. 2

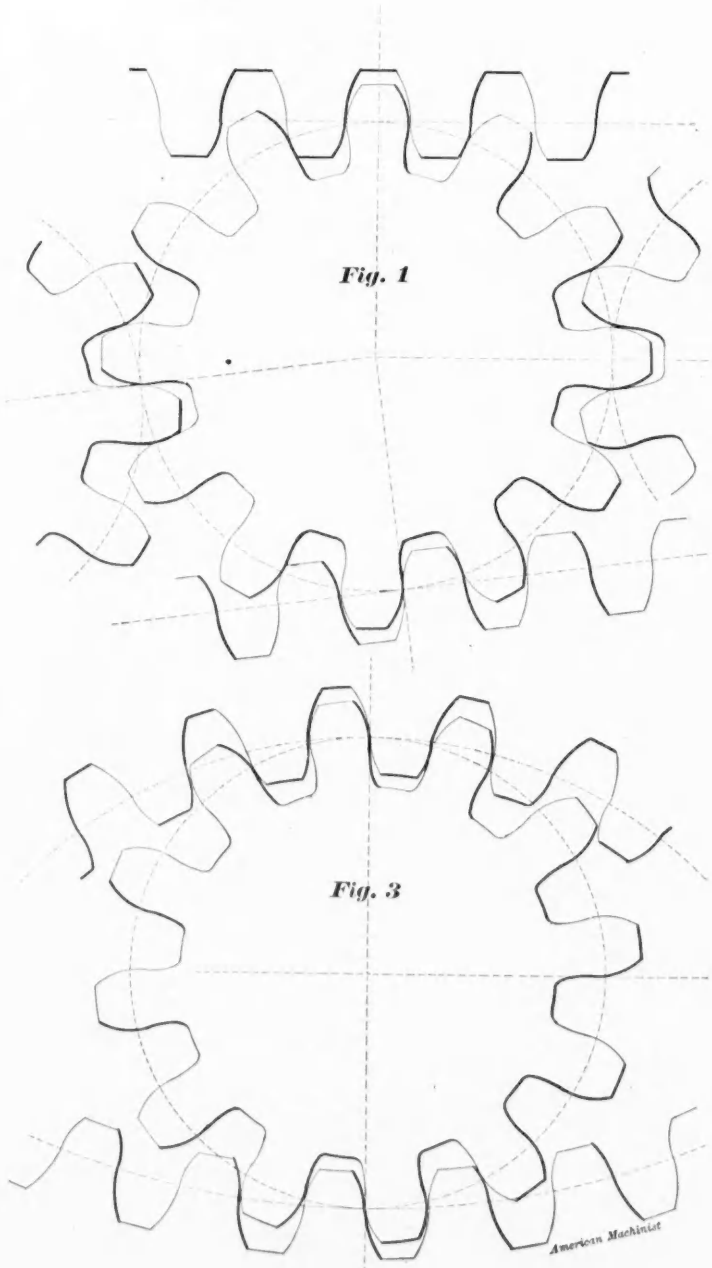


Fig. 1

Fig. 3

Gear Teeth.

of the gear or pinion with which it meshes. Those using chordal pitch are particularly apt to forget this fact. C. H. Campbell.

Watertown, N. Y.

Paint for Stand-Pipes.

Editor American Machinist:

In No. 449, under Questions and Answers in the American Machinist of September 7th, you are pleased to make mention of Dixon's silica graphite paint for stand-pipes. For this courtesy please accept our thanks.

For the outside of stand-pipes it will prove a decidedly serviceable article. It has been thoroughly tested, and so far as we can learn gives better satisfaction than any other paint.

You also advise that the stand-pipe should be painted inside as well as outside. We quite agree with you that it should be, but here arises a problem. A paint that will stand on the outside will not stand the action of the water. We do not recommend graphite paint for such purposes, and in fact none of the paint which you mention will give good service. This opinion of ours is based upon our experience and the experience of superintendents of water works.

Two pieces of iron painted with graphite paint were suspended in a stand pipe last February, one being immersed all the time and the other only part of the time, this being the conditions of the inside of the stand-pipe. The superintendent expressed himself satisfied that the graphite paint seemed to give better service than any paint that he had before tried, but it was not an ideal paint. * * * *

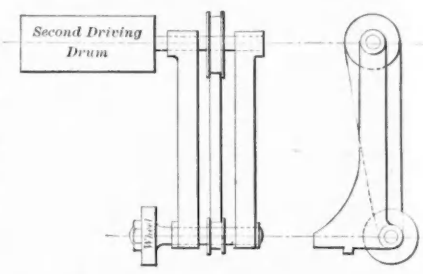
Jos. Dixon Crucible Co.

Grinding—Cliques—Shrinkage.

Editor American Machinist:

In making a center grinder for your lathe it is sometimes difficult to rig the overhead drum (as well as to get the foreman to buy it for you sometimes), and so there is another scheme which can sometimes be worked to advantage, if you happen to have a lathe right behind you that is vacant part of the time. In this particular case there was a lathe so situated, and the tool maker rigged a grinder as shown in the sketch. There was an upright of cast-iron as shown, and this contained the grinding spindle and the driving drum also, and was fastened to the tool-post block on the lathe carriage as is usual.

The overhanging drum shown at the top of the casting is the driving drum, and is driven from the drum behind in the other lathe. This prime mover is driven between centers, and in turn drives the drum shown, and from this the wheels. The movement of the carriage is taken care of by both drums, and an inch flat belt is used, giving



good power at the wheel, but though called a center grinder it is not so used, and cannot be so used with this method of driving, as will be seen, at least not without severe modifications.

This has been used for inside grinding to some extent with quite small wheels, and is run at about 3,500 revolutions per minute, doing good work at this speed, but of course should be altered for larger wheels.

There has come to be considerable cold sawing of metals done, especially in such work as builders' iron and bridge work, and it is doubtless an advance in the methods, but is it not in reality simply milling, with a large diameter cutter and coarse teeth, or perhaps not coarse for that diameter but coarse for ordinary work? There may be exceptions to this, but the saws can very readily be likened to milling cutters, and the work becomes an old friend instead of something new. The large diameter mill is a step in the right direction, where it can be used, and coarser teeth than formerly are also right for many kinds of work; the coarse teeth giving a much better chance for grinding.

Some object to them on account of not giving as smooth a cut, and perhaps they do not in all cases, but with the teeth cut spirally they will do good work.

Where it is necessary to use two cutters or to take two cuts, it will often pay to use a coarse tooth mill for the roughing cut as it can more readily be ground, and then finish with a finer one, the little work that the second mill does not having a bad dulling effect on it.

I have always favored coarse teeth for mills wherever they can be used, and have had no cause to alter my opinion as yet, although I may be brought up standing any day, by some job that cannot be well done by them.

There has been something written about the manner of feeding work to a mill, and while away on a western trip I made the acquaintance of a tool maker who told me of his experience in using a thin mill, a saw in fact for slotting plates (brass, I think) about an inch deep.

He said that when feeding the work *toward* the cutter as is usually the case, and as is recommended by nearly all the makers of milling machines, the mills would not stand well at all, so he tried running the work the other way, weighting the carriage so as to prevent a possibility of its "dragging in" to the extent of the lost motion in the feed screw.

Strange to say this way of feeding had a better effect on the mills, and they would last much longer without grinding, and gave less trouble than the other way.

I had heard of a similar case before, and was very glad to hear something more on the subject, even if it was against what I had expected, for I confess, I cannot see any explanation for the phenomena that

looks reasonable. I have every reason to believe my chance acquaintance truthful, or at least morally so, for he may have deceived himself in some manner, and still I should like to know why there should be a difference, and what should cause it; who can tell? Small contributions to the explanation thankfully received.

Of course, for work having a scale on it, such as a casting or forging, the only way to do is to feed against the mill in order that the mill may come up under the scale after the first cut is made, but for clean metal there is not this to contend with and it does not bear on the case at all. Besides this there is the objection of weighting the carriage, and unless we do, there is the danger of pulling into the work from the slightest lost motion, so that unless there is an advantage in feeding *with* the cutter it is objectionable, and if it is an advantage, the sooner it is generally known the better.

Cliques in shops are as bad as, or worse than, cliques in society, for they have a faculty of doing injustice and damage that is more materially felt than the society clique, as this one affects the parties' pocketbooks very often. There was a dull time in a shop not very long ago, and it was thought necessary to reduce the force, as the reduction in hours to 50 per week had not been sufficient, and the list of dismissals was made out with the help of the foreman. But the manager had great confidence in the foreman of one special department, who was, of course, subject to the general foreman, and before laying off any of the men in his department, he consulted this subforeman, whom we will call Horton, as to the merits of the men. The first man on the list was discussed, and to the manager's surprise, Horton's story did not agree with that of the general foreman at all, and explanations were asked for which resulted in the manager having his eyes opened to the fact that the foreman was not a reliable man to have in charge. The man who headed the list had all the crimes on the shop calendar charged to him; blunders, mistakes and poor work generally were his recorded doings from the foreman, but Horton, who is a man for square dealings every time, soon dispelled most of these charges very effectually.

He said he considered the man mentioned as his most reliable man, his best workman, and the best man to be sent out on a job for repairs. The mistakes charged to him were, for the most part, mistakes which had occurred before the work reached his hands, yet the prejudiced foreman and the other members of the clique would charge the mistake to him. Not that he was perfect, or that he never made blunders, but when he did he acknowledged them, and showed them up himself (something none of the rest did), and yet he was on the verge of being thrown out of his position and livelihood because he did not belong to the clique who were not working for the interest of their employer, and whose actions were costing him a great deal of money every month. This is but a small part of the actions of the clique, and much more might be told, but this will suffice to show how dangerous they are to a shop's welfare, and how contemptibly unjust their actions are to those not in the ring with them.

In large shops there are apt to be cliques of more or less strictness, although they do not always spread to such extent as the one mentioned. It is but natural that the men of similar tastes should seek each other's company during the nooning hour, and thus form little groups; these are not referred to as cliques, but rather the ones who try to dominate the shop, making it unpleasant for any man who attends to his own business, and does not knuckle to the "gang." As a rule these cliques are a detriment to any shop, and the men who will thus try to bulldoze the rest have no good place there, but when the foreman is also one of their number, and has his favorites for special favors, a new foreman is a very desirable feature for the shop. This kind of a foreman always has a few men who get all the extra work and good jobs, and as a rule the men who get the extra work are not the men who need it the most, but those who are special chums or favorites of the foreman. A much more just way is to give the extra work to those having families to support, or others that need it, and a good, sensible foreman will make it a point to do this every time. Keep out of cliques if you know what is best, for they are not always going to hold sway, and even if they did, it is better to quietly drop out of the shop than get into the way of being unfair to others as you must do in order to be in the ring of favorites. The foreman who finds a clique has a hard fight before him, and he must be careful in his actions, or he may get into a trap, but the firm who has a clique headed by the foreman should use prompt and decisive measures toward rooting out this evil, which can hardly be condemned in too strong language.

The allowance made by some patternmakers and blacksmiths for finish is amusing at times, and would be more so if it was not for the time it takes to turn or cut it off before the work can be finished. On pieces which are apt to spring we often find the finish insufficient, while on solid pieces which require little turning, a quarter-inch must be taken off, and this is more apt to be true with the average blacksmith than the patternmaker. A good lathesman will finish a piece of metal on a $\frac{1}{16}$ of an inch or less, if it is round or nearly so to start with, and a planer hand can do nearly as well with his castings, yet we usually find at least an eighth to come off, and sometimes this amount on each side, making extra work that should not be necessary. It is very easily understood how a man feels with a large pattern, and he would rather have a little too much metal to be worked off than to have it come a little scant. But after finding that several castings come a little full, it is time to dress it down a little, and then see how the next one comes. The patternmaker should give his own allowances for shrinkage and finish, the latter being understood with the shop foreman, so as to have harmony there, while the drawings should tell him the finished sizes of the articles, and denote in some way the finished parts, and also the parts left rough. It is well for the drawing-room to know what allowance is made for shrinkage and finish in the different metals, but it should lie with patternmaker and shop foreman what these amounts should be, as the drawing-room simply shows the finished article without reference to the amount of finish allowed for, or the shrinkage.

The extra metal that has to be worked off in many cases would make quite a showing in profits sometimes, and this is particularly so where the mold is made by loose pieces which have to be set by measurement, as in making fly-wheels by the sectional mold plan, or sweeping up a mold for cylindrical castings. It seems to be a standard maxim among some manufacturers to use the sweep method all you can when you make your own castings, but to be careful about using it where you hire them made. This comes from the tendency, partly natural and sometimes stretched for business purposes, of making the casting a little full so as to be sure there is stock enough on it, and thus adding to the weight considerably. I have known a fly-wheel to come over a ton too heavy from not setting the mold sections accurately enough, and allowing the metal to force the mold out larger than originally intended. To a great extent molding seems to be sort of an experiment and the shrinkage will vary sometimes, depending upon many conditions which are hardly ever twice alike, and looking at it from this standpoint we should be a little more charitable toward pattern makers when the finish allowance is too large, and this is particularly so on large work. In small castings there is really little chance of difference, and here the lines can be more closely drawn. There is less excuse for the blacksmith in allowing such a large finish, unless it is because the calipers he uses are not sensitive enough to set to the marks on the rule, or because he is afraid the piece is not round and makes the allowance for rounding it up, but as a rule his allowances are too generous and can be cut down one half, in many cases, sometimes more than this.

This is one of the advantages of drop forgings or rolled work, and where they can be had they are far superior, as far as size goes, to any hand-work.

Where there is a quantity of a certain piece to be made the drop-forging method is quite cheap, and in some instances to the writer's knowledge they have replaced steel castings at the same price, and in some instances have been found slightly cheaper, when the shape of the piece and the metal in it was favorable. Drop forgings possess the advantages over castings of not having an unequal shrinkage, and of having all the pieces very nearly, if not quite, alike, more so than with any casting.

Worcester, Mass. Fred. H. Colvin.

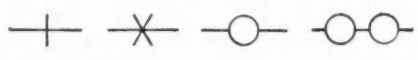
Marking Steel.

Editor American Machinist:

I noticed in one of your issues a good suggestion taken from "Sparks from the Crescent Anvil."

We like the idea first rate. We use for this purpose special punches like those shown in the figure, which seem suitable for all sizes of stock. We mark one end of bar, and cut from the other end. The brand of steel which the punch represents is marked on side of punch; but, of course, we at once become familiar with the marking without referring to this.

This we think preferable to the paint, in some shops anyhow, when the paint is not always ready for use Our plan, however, does not admit of our distinguishing



the brands way across the shop, as the paint plan would, but we have no difficulty in this direction, as our steel rack is right beside a row of windows.

Sometimes we want to mark a tool or cutter made from some particular brand of steel to note results, and our punches can generally be used for this purpose very nicely. F. R. Hynes.

Bicycle Boats at Fairmount Park.

Editor American Machinist:

It may be of service to J. C., Bridgeport, Conn., to know there are bicycle boats in Fairmount Park (Philadelphia).

I think they are the same as were in use at the Centennial Exhibition, and are still much enjoyed, apparently.

These are metallic and have two hulls with a paddle-wheel between. If J. C. is much interested he had better visit there.

Wm. G. T.

A Lathe Device.

Editor American Machinist:

Having occasion to cut a lot of scroll threads on disks, and having only a common 24 inch New Haven Manufacturing Company's lathe, I was puzzled for a time how to do the job.

With the addition of a piece of $\frac{3}{4}$-inch square iron bent and drilled as shown in the sketch, I converted the lathe into a scroll lathe with the whole range of the screw gear train.

Perhaps some of your apprentice readers can figure out how I did it.

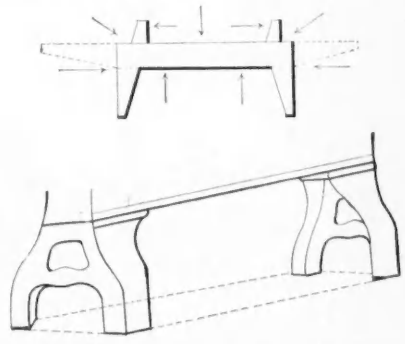
Benj. F. Wilson.

Legs of Machine Tools.

Editor American Machinist:

In your issue of August 24th., and in reference to "Chip's" remarks on the form of leg in Fig. 1, whilst fully indorsing the superiority of the cabinet legs, or where desirable the box form of base, as in Fig. 2, we think the arguments against the broad top or American leg are but another example of the very general neglect on the part of designers of machinery of the elementary consideration of the resultant of forces. In considering the question of machines mounted upon legs, it should not be forgotten that the base of the individual leg is not identical with the base of the machine as a whole; the base of a machine is that area which is bounded by straight lines connecting the extreme points of support, these points in the case of a lathe, etc., being the four points of the legs as per rough sketch, so that possibly the machine as first projected by "Birchall" would have possessed a much greater base than the one finally adopted, Fig. 2.

The *individual* base of the leg is at the point of connection with the bed as it is from here that all strains and vibrations proceed, and if the attachment of this base



is rigid it does not matter theoretically how the points of support on the floor may be reduced, provided they inclose ample area.

Again the lathe bed and its legs may be taken as a beam with the ends turned down, and subjected to a complication of forces, the vertical forces being counteracted by the forces between the centers and the rigidity of the bed, and *vice versa*, the horizontal and angular forces being provided against by the strength of the beam and the rigidity of the joints of the beam that is at the point of connection of leg (or tapering end of the beam). Taken in any light the broad top or American leg is correct enough for us on this side to take a lesson from as being right.

Keighley, Eng. Lister & Co.

Water Bicycle—Nipple Holder—A French Shaper.

Editor American Machinist:

In your answer to J. C., Question 468, you seem to infer that a water bicycle cannot be propelled with much speed, but I have seen them go very fast, and if J. C. will write to David North, Portsmouth, N. H., who has got a patent on them, he can find out all particulars. J. C. is in error as regards there being no bottom, for each float is water-tight, but there is an open space between them.

Your World's Fair correspondent described a nipple holder as something new. A fellow workman of mine, John Critchley, made a set from $\frac{1}{4}$" to 2", inclusive, about 1870 or 1871, and I used them considerable for many years and found them very good.

Your correspondent also describes a shaper that cuts on the in-stroke, or what we usually call on the back-stroke. In 1875 I went to Santiago, Chili, to a world's fair, and there I saw a shaper and saw work being done on it, that cut the same way. I don't remember the maker's name, but it came from France, I think. N. W.

Portsmouth, N. H.

Judging from the large consignments of American-made paper now being discharged at the Thames docks, English paper-makers are likely ere long to feel the pinch of very serious competition; for, though they have already been affected to some extent by the competition of Continental rivals, yet the improved machinery employed in the United States, the low price at which superior qualities of paper can be produced there, and the small amount paid for freightage relatively to the cost of railway carriage in this country, all contribute to the Americans being able to oust British manufacturers.—*Birmingham Weekly Post.*

AMERICAN MACHINIST

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Headquarters at the Fair.

During the continuance of the Chicago Exposition the AMERICAN MACHINIST will have its headquarters in the space allotted to the Mechanical Press in Machinery Hall. The exact location is Section No. 27, Column K 37. Word can be left with the attendant there by any one who is desirous of meeting a representative of this paper, who may at the time be engaged elsewhere on the grounds. As the majority of our friends who visit Chicago during the continuance of the Fair will spend a considerable portion of their time in Machinery Hall, we invite them to make use of our facilities there by having their mail addressed in our care as above, where it will be cared for and delivered on demand either by our own representative or by the person who cares for the space in which our desk is located.

Another Accident.

As we feared would be the case, the accident on the Big Four road to which we referred last week, was closely followed by a worse one, this time on the Wabash road.

The season has been a disastrous one when the great number of serious railway accidents are considered, and some measure seems to be necessary to better protect those who must travel about the country.

There is little doubt but that if the men whose business it is to manage railroads were allowed to actually manage them without the hampering interference of those who know nothing of railway management, and are so situated as not to feel the personal responsibility that owners should feel for mismanagement of their property, things would be different. As our railroad business is now managed, a man who spends his time in Wall street or some other financial center may practically own a railroad. He knows nothing about the practical management of it, but does know whether he wants the road to pay dividends, pass them, or go into the hands of a receiver, his preference in these matters depending upon what particular stock gambling scheme he may at the time be engaged in.

Those officials who are supposed to have the management of the roads, and who take the censure when things go wrong, are actually so hampered in many cases that they should be entirely relieved of all moral responsibility. Laws requiring certain safeguards against accidents would probably be welcomed by this class of officials, who find themselves compelled to consider first and above everything else, dividends—immediate and regular dividends, perhaps, though the paying them may mean the prohibition of improvements which, while expensive, would in the end prove profitable.

It cannot be said that American railway management has placed itself in a very favorable light this season. By the narrow and selfish course pursued by the roads early in the season, they seriously impaired the success of the Fair as well as cheated themselves out of a large volume of business, while since travel has largely increased they have made a record of accidents which is disgraceful if not criminal.

The Question of Prizes.

A well-known builder of machinery suggests that instead of the judges of machinery at an exhibition attempting to decide which particular machine of a class is absolutely best, all things considered, it would be better to divide the features or attributes of the machines and pass upon these separately, grading each machine upon these separate points, each without regard to the others.

To illustrate, take, for instance, rock drills. The general appearance or elegance of design of the different machines may be compared, and each graded, in percentage, 100 representing the highest degree of excellence. Thus the machine best in this single feature would be graded at 100, while perhaps under the head of "workmanship" it might fall to 90; under "accessibility for repairs," 80; "convenience in handling," 75; "economy in use of steam or air," 70 and so on; some machines excelling in points at which others fall short, and *vice versa*. It might thus happen that the final aggregate rating of several machines would turn out to be the same, and that might be all the better. Any one who cared to investigate the matter could easily find what machine was considered superior in the particular points in which he is especially interested.

An award under this system would certainly have more meaning and a more definite meaning than by the present system, and, we think, would leave less room for charges of favoritism or corruption, because the basis of each independent element composing the investigation would be more plainly apparent and more readily understandable.

But after all it is probable that the day is coming when special awards or prizes at exhibitions will be done away with entirely.

It is not at all probable that buyers of rock drills, machine tools or engines are or will be much, if at all, influenced in their choice of machines by considerations of prizes which after all must be based upon the judgment of those whose judgment the buyer will not consider better than his own, or that of his engineer acting in his interest.

A prominent builder of woodworking machinery informed us recently that he had just melted up all the medals received at exhibitions, and proposed to entirely discontinue all reference to them in advertisements or otherwise. He thought they carried no weight whatever.

A manufacturer who is striving by fair means or foul to secure a medal or prize at an exhibition, may get some idea of whether the game is worth the candle or not by stopping to think just how much attention he himself pays to that part of a trade catalogue or circular, which refers to prizes or medals won by the advertiser. He generally pays no attention to it whatever, and he may be reasonably sure that others almost unanimously do the same.

An English Co-operative Scheme.

The announcement comes from England that after a year's consultation between coal owners and experts, Sir George Elliott proposes a co-operative scheme by which all coal lessees should unite, and after certain other dividends are paid, divide part of their profits among the workmen, the Lord Chief Justice fixing the price of coal.

We have been under the impression that employers and employes alike in Great Britain have been oppressed with the necessity of paying exorbitant "mineral royalties" to the coal mine owners, who there constitute a distinct class that do nothing much but have a good time and collect princely revenues for the privilege of digging "their coal," their title to this coal being derived for the most part from unjust and even grossly immoral transactions of many generations gone.

We fail to notice anything in the new scheme which will prevent these hereditary owners from doing just as they have been doing, *i. e.*, "charging all the traffic will bear" in the way of royalties, to the grief of industries, coal buyers generally, miners, and mine lessees.

A mechanic who has occupied a number of responsible positions, in which he had followed others in conducting manufacturing operations, and been obliged to accept things pretty much as he found them, shaping his course largely to suit what had been previously done, got to wishing finally that some day he might happen to be the first man in a new enterprise where he could lay out things according to his own ideas, and have none of what he regarded as the mistakes of others to either continue or correct. He finally secured such a place, and after some experience in it, declared that he had never before fully understood the difficulties of the pioneer, his multitudinous chances for mistakes, and for leaving the bars down for future criticism by others. He now thinks it is easier to follow after others, do as well as you can, and then have your predecessors to blame for shortcomings; all of which again illustrates the truth that each man best appreciates the difficulties of his own position, can in the nature of things never fully appreciate the difficulties of others, and is too apt to conclude that they haven't any to speak of.

The Young Men's Institute.

On Tuesday evening, October 3d, special exercises were held in the hall of the Young Men's Institute, 222–224 Bowery, to formally open the educational work for the season of 1893–1894. This institute has for several years been doing good work in offering to young men engaged during the day exceptionally good evening classes in subjects bearing directly on their daily work. There are technical subjects which assume a prominent place in the curriculum: classes in carriage drafting, steam engineering, practical electricity, mechanical, architectural and freehand drawing; also in practical arithmetic, penmanship, bookkeeping, shorthand, typewriting, English grammar and composition, vocal music, glee club, and first aid to the injured. The school year continues until May, when prizes, diplomas and certificates will be awarded. The classes are open to all young men from 17 to 35 years of age.

Literary Notes.

PATENT OFFICE MANUAL, including the Law and Practice of Cases in the U. S. Patent Office, and the Courts holding a Revisory Relation Thereto. By George H Knight. Published by Little, Brown & Co., Boston.

This book is intended to facilitate the work of inventors and patent attorneys by supplying a convenient summary of the more important rulings.

It includes some very recent and important decisions, and the entire matter of the book is methodically arranged for convenient reference. The book will prove very useful to all those who have much to do with patents, or with copyright matters. There are 655 pages, 6″x9½″, law calf binding.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(486) B. W. S., Baltimore, Md., asks: Did you publish some articles on the construction of the link motion with the lessons on practical drawings? If so please inform me of the date of issue, and whether I can secure them. *A.*—The article you refer to appeared under the head of "Modern Locomotive Construction," in our issue of December 4, 1886. There are also four articles on "Laying out Link Motion" in our issues of May 10, 17, 24 and 31, 1884. We can furnish any or all of these issues.

(487) L. W. C., Wayland, Mich., writes: In designing a plain journal, is it practicable to make its diameter greater than need be for strength, that it may have sufficient bearing surface, or would it be better to make the journal longer? *A.*—When there is no objection to the length of the journal as in ordinary shafting, the best practice is to make the diameter just large enough for strength and then adopt a length for the journal which will keep the pressure of the journal on the bearing within such limits as to prevent heating.

(488) M. M., New Orleans, La., writes: I am about to buy a slide valve engine for my shop, and would like to have some kind of a cut-off motion to save steam. Would it be proper to have a link and eccentric motion? I understand that the governor does not affect the cut off, but merely keeps the engine running at a uniform speed. *A.*—There are several kinds of automatic cut-off

engines on the market in which the governor not only keeps the engine running at a uniform speed, but also regulates the cut-off. Any one of these engines will do your work economically without attaching a link motion.

(489) H. C. W., Huntington, Pa., writes: Kindly give the names of good books treating on lathe work as applied to metal working. *A.*—"Turning and Mechanical Manipulation," intended as a work of general reference and practical instruction on the lathe, etc., by Chas. Holtzapffel, is well thought of; but it is an expensive work—$46. It was published in 1866, and we believe that copies of it are now scarce. "Modern Machine Shop Practice," by J. Rose, is a cheaper work and may suit your purpose. 2. Are the series of articles on "Practical Drawing" by J. G. A. Meyer, suitable for self-in struction? *A.*—Yes; they were written for that purpose.

(490) T. J. B., Philadelphia, Pa., writes: I would like to have your opinion as to what portion of cut gear teeth should show contact to run quietly. Some claim the driver should show bearing from the pitch line to the point, while the driven should show from the pitch line to the root of the tooth. Others claim that all gearing should bear only from the pitch line to the points of the teeth; and yet there are others who hold that the bearing should be from the point to the root. *A.*—Each tooth should show contact along the whole face, that is, the portion lying between the pitch line and the end of the tooth, and it should also show contact along a part of the flank of the tooth.

(491) J. T., New York, writes: Kindly state the price and name of a book that treats practically on the construction of hydraulic and pneumatic machinery, and especially on the various systems of centrifugal pumps and hydraulic presses. *A.*—"Hydraulic Power and Hydraulic Machinery," by H. Robinson, price $10, we believe to be a good book treating on hydraulic machinery; but we do not know of book treating on pneumatic machinery that we would care to recommend. For the construction of pumps we should recommend "Pumping Machinery," by William M. Barr, price $5. 2. I heard that steel can be hardened even when cold by simply rubbing it with some kind of acid. Is this true? If so, what is the process? *A.*—We do not know of any such process.

(492) J. T. L., Chicago, Ill., writes: I have designed an automatic machine, and not having the means to patent it, I would like to know if there is any means of protecting the invention so that I can show it to manufacturers. *A.*—You may obtain immediate protection by filing a caveat, which consists of a petition, oath, specification of invention and drawings—no model is required. The filing of a caveat prevents during its existence the issue of a patent without the knowledge of the caveator, to any person for a similar device. Should a competitor apply for a patent the caveator is notified, and called upon to file his application for a patent within three months from date of notice. Of course, expenses are connected with the filing of a caveat, but they will not be as great as the expense of taking out a patent. We do not know of protecting the invention in a cheaper way. 2. Can manufacturers make and sell articles made with this machine? *A.*—Yes.

(493) J. L., Toronto, Canada, asks: What thickness of metal is required in a hydraulic cylinder 12 inches inside diameter to stand a working pressure of 1,500 pounds per square inch? *A.*—We should make it 1¼ inch. 2. What is the most approved mixture of cast iron for such a cylinder? *A.*—Very compact brands of gray iron, hardened by a plentiful admixture of good scrap which shows a small crystal in the heavier fragments will answer the purpose well. 3. What is the best style of packing for the same? *A.*—We presume you mean the packing for the ram; we should use a stout leather ring, whose cross-section resembles the letter U, fitted in an annular groove in the cylinder head, and placed in this groove so that the concave side will be towards the water pressure, so as to force one side of the packing against the ram, and the other side against the walls of the cylinder.

(494) J. S. R., Philadelphia, Pa., writes: Kindly tell me if a crank-shaft of an engine is made strong enough to resist the twisting strain, or is it made strong enough to resist the weight of fly-wheel? It does not seem to me to be strong enough if it is made to resist the twisting strain only. Please give rule for computing the diameter of a shaft that will be safe for all the forces acting upon it. *A.*—If it was simply strength that was aimed at in designing an engine crank-shaft, it would be made strong enough to resist the flexural stress due to the weight of the fly-wheel and the torsional shearing stress combined. But strength is not the only thing to be considered; the journals must be made large enough to run cool, and when large enough to prevent heating, the diameter of the shaft will generally be considerably larger than is required to resist all the forces which act upon it. In order to prevent heating, the aim is not to allow the pressure per square inch of projected area of the journal to exceed 800 pounds for stationary engines. By projected area is meant the area of a rectangle whose length is equal to the length of the journal, and whose breadth is equal to the diameter of the journal. When these requirements have been met, the diameter of the shaft for small engines with cylinders up to 20 inches diameter will be nearly equal to one-half the diameter of the cylinder.

(495) J. D., Philadelphia, Pa., writes: I have a small vertical direct acting triple expansion marine engine with cylinders 2⅜, 3 9/16 and 5 5/16 inches in diameter, stroke 3½ inches. The steam ports of the high pressure cylinder are 1¼ x 5/16 inches. Piston valves are used for the high and intermediate cylinders, and a plain slide valve for the low-pressure cylinder. Steam pressure, 120 pounds is furnished by a 3 horse-power boiler. What I wish to know is, how many revolutions per minute will the engine make, and how much power will it develop? If this data is too meagre kindly inform me as best you can from the data. *A.*—The horse-power which the engine can develop will depend much on the steaming capacity of the boiler. The term "horse-power of a boiler" is a very indefinite one; if you mean that the boiler can furnish steam enough for the engine to develop 3 horse-power only, then this will be the limit of the power of the engine. To develop this power the engine, if non condensing, will have to make about 190 revolutions per minute. This speed is too slow for a marine engine of this size; a more appropriate speed will be about 300 revolutions per minute, and with this speed the engine (non-condensing) will develop about 4¾ indicated horse-power. If it is a condensing engine, the power will be increased by about 20 per cent.

(496) S. N. B., Austin, Ill., writes: Kindly give me full particulars in regard to the construction and working of the hydraulic ram. *A.*—The hydraulic ram is a self contained and automatic pump operated partly by the pressure of a column of water in a pipe, and partly by the stored-up energy acquired by intermittent motion of the column. In its simplest form, it consists of a main pipe placed on an incline leading water from a spring or reservoir at the upper end of the pipe to an air chamber attached to the lower end of the main pipe; this air chamber is connected to a tank placed somewhat higher than the spring or reservoir. To the lower end of the main pipe another smaller pipe is attached extending downwards, with a cock at the lower end, from which water is drawn for, say, domestic purposes. When this cock is opened, the water in the small and main pipes is put in motion, and acquires a velocity due to the head; as soon as the cock is closed the momentum of the column of water opens a valve in the air chamber, and the water rushes into this chamber. This effect takes place every time the cock is used, and as water is drawn from it at short intervals for household purposes, an abundance of water will be raised in the tank. 2. Where can I get a copy of the Patent Office report? *A.*—From the Commissioner of Patents, Washington, D. C.

(497) M. P., London, W. C., asks: Is it theoretically correct that the draught of a given chimney for a boiler varies inversely as the sum of the length of flue and height of chimney? *A.*—No. 2. What would be the effect practically of increasing the length of the flue from 5 to 100 feet leading to a chimney 120 feet high, all other conditions remaining unchanged? *A.*—The increase of the length of the flue will decrease the power of the chimney. The effect of changing the length of the flue leading into a chimney 60 feet high and 2 feet 9 inches square is given in the following table, which has been taken from the "Practical Treatise on Heat," by T. Box:

Length of flue in feet.	Horse-power.	Length of flue in feet.	Horse-power.
50	107.6	800	56.1
100	100.0	1,000	51.4
200	85.3	1,500	43.3
400	70.8	2,000	38.2
600	62.5	3,000	31.7

The temperature of the gases in this chimney was assumed to be 552 degrees Fahr., and that of the atmosphere 62 degrees. The effect of changing the length of the flue from 5 to 100 feet in your case will depend on the temperature of the gases in the chimney and the outer air. But the foregoing table will probably indicate sufficiently the rate of change of power caused by the increase of the length of flue.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's Gears, Lex'n, Mass., & Phila., Pa. See p. 12

Ideal Drawing Stands. M. C. Hammett, Troy, N. Y.

Forming Lathes Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith M. T. Co., Mill., Wis.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

For Cypress Tanks and Vats, address W. E. Caldwell Co., Floyd and Main Streets, Louisville, Ky.

Speed Gage, shows speed and all variations. Geo. T. McLaughlin & Co., Boston, Mass.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt, Newark, N. J.

Gear and Rack Cutting, Drawings for Bevel & Miter Gears, Cutters for Spur & Bevel Gears Milling Cutt's, Vert'l Mill'g Mach's. R M. Clough, Tolland, Ct.

"Pumping Machinery." New book, 450 pp. 8vo, 270 Eng. Prospectus free. W. M. Barr, 3223 Powelton Avenue, Philadelphia, Pa.

12-inch breech-loading rifled mortar & mounting, w'ght 118,000 lbs., front Gov't B'ld'g, World's Fair; des'n on applica'n. Builders Iron F'dry, Prov., R. I.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears
Gould & Eberhardt, Newark, N. J.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co. 203 Broadway, New York.

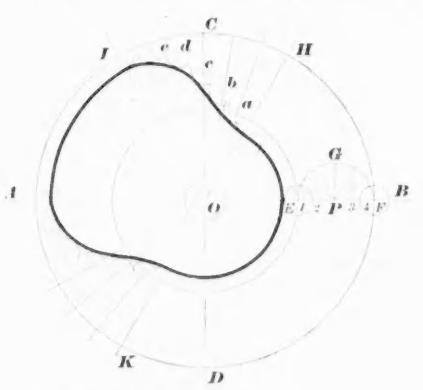
"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Cams.

By C. L. Redfield.

While I am not disposed to use cams when there is any other good way of accomplishing the result desired I have found many cases where cams seem to be the only practical device.

In cases where the required movement is of a certain quality the curve of the cam is a predetermined quantity, and the only problem is to lay out this curve in its proper proportions. When, however, the movement is one of simple translation from one point to another in a given time without regard to the quality of the movement except that it be easy, I have found a movement that is equivalent to a crank movement very



satisfactory in practice. When there are no specific reasons for adopting a movement of a particular quality the use of this kind of a movement has certain advantages. One is that it is of a known kind, and another is that it is easy to lay out. The method of laying out this kind of a cam is shown in the accompanying diagram.

On the axis *A B* draw two circles *E* and *F* representing the diameter and extreme positions of the roller to be moved by the cam. Locate the cam shaft at *O* on the axis *A B* sufficiently far from *E* to give a fair working size to the cam, and from *O* draw construction circles through *E* and *F*. From a point *P* midway between *E* and *F* draw the semi-circle *E G F* representing the path of a crank-pin in passing from one center to the other. Divide this semi circle into any convenient number of parts and drop perpendiculars from these divisions to the axis *A B*. Lay off on the large construction circle that portion of the circumference through which the cam movement is to take place, as *I H*, and divide this distance into as many equal parts as there are divisions in the semi-circle *E G F*, and draw radial lines to represent these divisions. From *O* as a center and with radii O_1, O_2, etc., cut the divisional lines between *I* and *H* at *a*, *b*, *c* etc., and with these points as centers draw arcs with a radius equal to that of the roller to be moved, when the proper curve of the cam may be drawn tangent to these arcs. The completed cam is shown in heavy lines. The reverse movement of the roller takes place between *A* and *K*, the cam between these points being a duplicate of that between *I* and *H*.

Two cams made in this way and located in line on parallel shafts with a roller between can be used instead of an internal and external cam, and will move a slide in the same way that a crank would move it, and with any desired pause at either end of the stroke.

The Origin of the "Apron Feed" Mechanism for Lathes, and the "Swiveling Bearing" for Line Shafting.

By W. F. Durfee.

In a paper read by me at the late Engineering Congress at Chicago, I stated, when speaking of the evolution of the "lathe," that "the invention of the 'apron' on the front of the 'tool carriage,' and the idea of attaching the various feed controlling mechanisms thereto, is believed to have originated with Baxter D. Whitney, of Winchendon, Mass., the well-known inventor of the 'gauge lathe,' who also devised the first swiveling bearing for line shafting."

At my request Mr. Whitney has kindly sent me drawings of the feed mechanism of the lathes made by him, and also of his swiveling bearing for line shafting, which drawings are reproduced on a reduced scale in the accompanying cuts.

Relative to the history of these inventions, Mr. Whitney writes:

Winchendon, Mass., July 26, 1893.

Dear Sir: I have had a drawing made of the carriage and feed of the engine lathe I spoke to you about, which I made in 1843, which is now in constant use in my shop, and has been ever since it was completed. The lathe is just the same in all of its parts as when first made, no alterations ever having been made. I do not know of any other lathe having been made previous to this with an apron feed.

Yours respectfully,
[*Signed*] Baxter D. Whitney.

Winchendon, Mass., Aug. 30, 1893.

Dear Sir: I have been so busy since I saw you at Chicago that I could not write you earlier as to the time of making my first pivot or universal journal box. I find on looking up old memoranda, that I made the first box mounted so as to conform or adjust itself to the axis of the shaft which runs in it, in the year 1837. Herewith I send a blue print of a pattern which I now have, made in that year. The first hanger to which I applied this box I made in 1845, and mounted the main shaft of my shop in a set of these hangers, that year. This hanger had a drop of 20", and carried a 3" shaft. I also made the same style of hanger that year with a 14" drop, and herewith send you a full sized blue print of it. I have a line of 2" shafting running in these hangers, as made at the time.

On the 26th of July I wrote you as to the date at which I made the apron feed lathe. I will now state that my first scheme for handling the tool carriage at a long distance from the head spindle was in 1837. I built that year a lathe which I now have in my shop. Up to that time I had been using a chain feed lathe, and, as you know, there usually is a good deal of slack in the chain,

and as much more in the gears, as made at that time, so that a person that wanted to get any work done would get tired of waiting for the tool to begin to cut after the feed was thrown in. To obviate this difficulty I made a cut rack and pinion, the pinion being but 2½″ diameter, and on the pinion shaft put a worm gear 24″ diameter, with 300 teeth. With this arrangement I could run the worms quite fast, and the space would be taken up so quick that the tool would begin to cut about as soon as the feed was thrown in. This worm-wheel has a bevel gear 10″ diameter on its inside, with a small pinion meshing into it, which is put on the end of a rod extending the whole length of the lathe. This rod has suitable handles placed at convenient distances apart, by which the carriage can be easily moved at any distance from the head spindle. This arrangement I considered quite an advance beyond anything at that time. Herewith I send blue print of this feed device. It is doing good work to-day.

Yours respectfully,

[*Signed*] BAXTER D. WHITNEY.

The drawings are so clear that very little explanation is necessary. Figs. 1 to 5 represent the details of the "apron" and "feed work" of the lathe built by Mr. Whitney in 1843. It will be noted that the rack, Fig. 5, occupies the same position as in many lathes of the most recent construction. The lever *L*, Fig. 2, is for throwing the "worm" out of gear with the "worm-wheel," which is provided with a bulbous projecting rim, Fig. 5, which enables it to be used as a "hand-wheel" when the "worm" is thrown out.

Figs. 6 to 8 show the construction of the swiveling bearing made by Mr. Whitney in 1837, and Figs. 9 to 11 show the same idea applied to hangers in 1845 for carrying a line of 2″ shafting now running in Mr. Whitney's shop. Figs. 12 to 15 show the details of hand gear applied to a lathe built as described in the latter part of the second letter above. The rack *R*, Figs. 14 and 15, was attached to the tool carriage, and moved with it. The worm-wheel had a double row of teeth (one for each worm) and a bulbous rim for the hand. The several inventions above described were certainly pioneer ideas in the lines to which they belong, and are certainly suggestive of a great deal of the practice which followed their date. Mr. Whitney in course of a very interesting conversation said that when in 1837 he inverted the swiveling box, he thought so well of it that he took it to a leading patent solicitor in Boston with a view of getting it patented, but that gentleman discouraged him by saying that it could have no practical value, as no one would ever want anything of that description for shafting. In consequence of this opinion no application was ever made for a patent, but the correctness of Mr. Whitney's early judgment is conclusively proved by the fact that no one at this day would think of putting up shafting without using some form of the idea originally proposed by him in 1837.

No criticism of the condition of the atmosphere in the Metropolitan Railway tunnels and carriages can be too severe. It has long been bad enough between Faringdon and Baker streets, but it has become much worse, and is sometimes simply intolerable between Temple and Westminster. When the conditions of working of these lines, the almost incredibly sulphurous and smoky condition of the air, and the high fares charged for short distances, are considered, it seems a marvel that any human being can be persuaded to use the lines at all, and no wonder that they do not pay.—London *Engineer*.

An Evaporative Surface Condenser.*

By PROF. JAMES H. FITTS.

The condenser herein described was built at the Virginia Agricultural and Mechanical College, at Blacksburgh, Va., after some observations were made on the rate of evaporation of water at different temperatures, and with a current of air passed over its surface. Its performance has been successful to such a degree that this paper is presented in the belief that it will be of general interest to the profession, and that it gives a practical solution of the question of condensation of vapor with a small water supply. While it may meet with criticism for its crudities, the author hopes to avail himself of this to make good any deficiencies for a future meeting of the society.

This condenser [see page 11], consists of two rectangular end chambers connected by a series of horizontal rows of tubes, each row of tubes immersed in a pan of water. Through the spaces between the surface of the water in each pan and the bottom of the pan above, air is drawn by means of an exhaust fan. At the top of one of the end chambers is an inlet for steam, and a horizontal diaphragm about midway causes the steam to traverse the upper half of the tubes and back through the lower. An outlet at the bottom leads to the air pump.

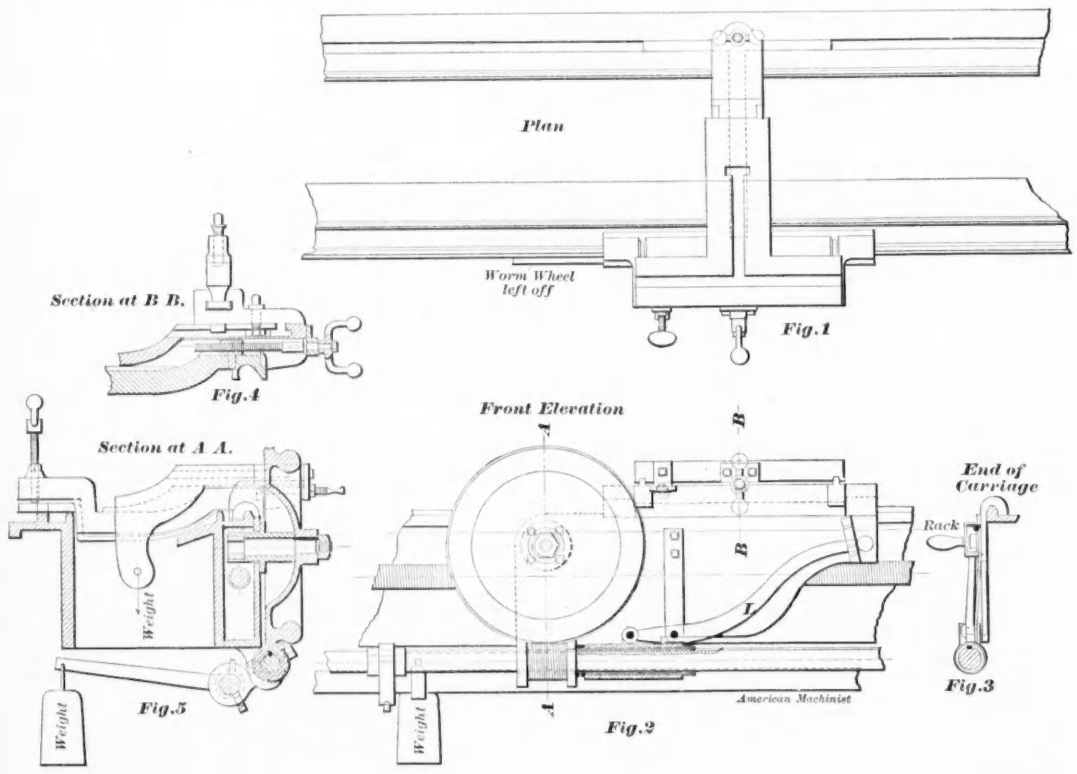
The condenser, exclusive of connection to the exhaust fan, occupies a floor space of 5′ 4½″x1′ 9¾″, and is 4′ 1½″ high. There are 27 rows of tubes, 8 in some and 7 in others; 210 tubes in all. The tubes are of brass, No. 20 B. W. G., ⅝″ external diameter and 4′ 9½″ in length. The cooling surface (internal) is 176.5 square feet.

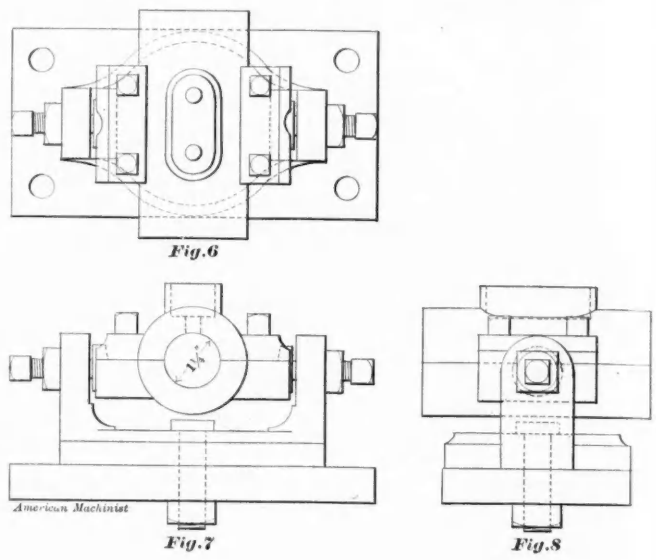
There are 27 cooling pans, each 4′ 9½″x1′ 9¾″ and 1 7/16″ deep. These pans have galvanized iron bottoms, which slide into horizontal grooves, ¼″ wide and ¼″ deep, planed into the tube sheets. Wooden strips are fitted into the grooves below the bottoms. The tube sheets form the ends, and angle irons 1⅝″x⅜″x⅛″ bolted to the galvanized bottoms, the joints packed with wooden strips, form the sides. The total evaporating surface is 234.8 square feet. Water is fed to every third pan through small brass cocks and 1¼″ overflow pipes feed the rest. (The drawing does not show the method of water supply.)

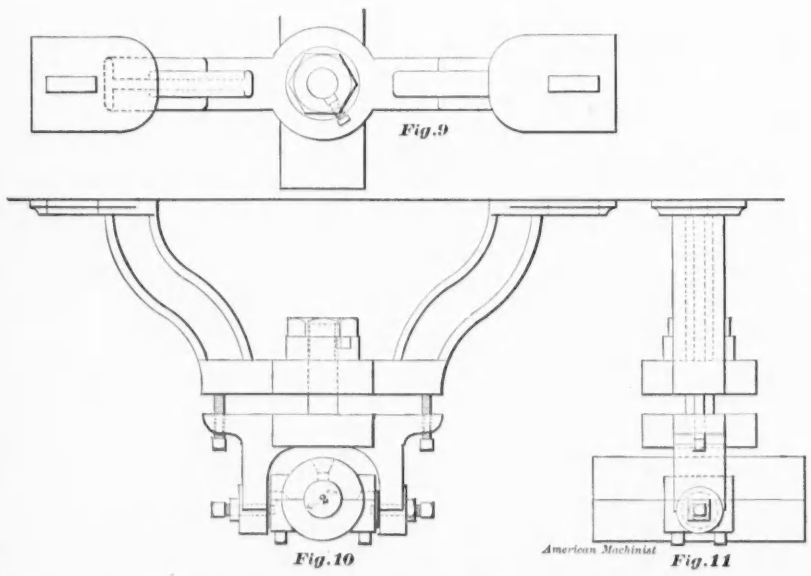
A wood casing connects one side with a 30″ Buffalo Forge Company's disk wheel. This wheel is belted to a 3″x4″ vertical engine.

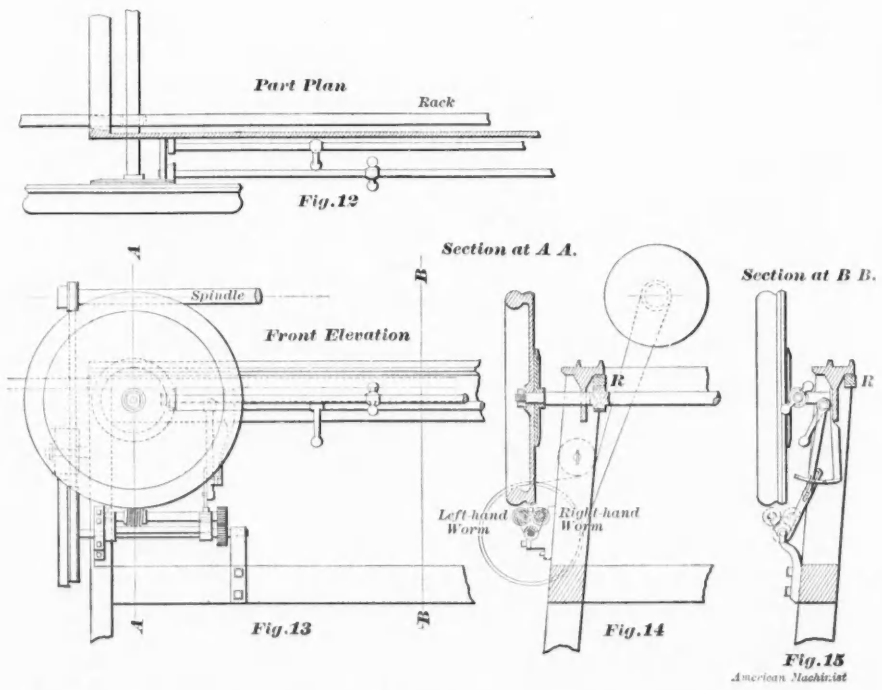
The air pump is 5¾″ diameter with a 6-inch stroke, is vertical and single acting. This pump acts imperfectly, due partly to a defective cylinder casting, and can produce a vacuum of only 24″ of mercury when steam is not admitted to the condenser. As the

* Paper presented at the Chicago meeting of the A. S. M. E. by the Secretary, Professor Fitts having been killed in a railroad accident while on his way to attend the meeting.









normal barometer reading is 28″ this indicates a residual air pressure of 4″.

The action of this condenser is clear. The passage of air over the water surfaces removes the vapor as it rises, and thus hastens evaporation. The heat necessary to produce evaporation is obtained from the steam in the tubes, causing the steam to condense. It was designed for the college shop engine, to condense 800 pounds steam per hour and give a vacuum of 22″, with a terminal pressure in the cylinder of 20 pounds absolute; but it was found practically impossible to get the long exhaust pipe air-tight, on account of its numerous connections. Direct connection was therefore made with the boiler. A number of runs of several hours' duration have been made with a boiler pressure of 60 to 70 pounds. The cooling water was run into a barrel placed overhead, and drawn from the barrel. The water of condensation was weighed. The following table shown below gives average results:

The overflow pipes for regulating the supply of water were found to be too small, so that at times some pans would be too full, causing waste of water over the edges, and at others the tubes would be uncovered with reduction in efficiency. This loss of cooling water will account for the amount being so much in excess of the water of condensation. The amount of steam condensed, if there had been no waste of water, would have been about 30 pounds less than that shown.

Accurate analysis of the transfer of heat could not be made on account of this waste. An approximate analysis, however, may be based on information obtained from the curve of evaporation given below.

Heat in 1 pound steam at 311° = 1,208.3 B. T. U.

Heat in 1 pound water at 149° = 149.

Heat rejected by 1 pound steam = 1,208.3 − 149 = 1,059.3.

Of each pound of water evaporated in the condenser, probably $\frac{5}{7}$ is at 140°, and $\frac{2}{7}$ at 115°.

Heat absorbed by $\frac{5}{7}$ pound water in being warmed from 60° to 140° = 57.1.

Heat of vaporization of $\frac{5}{7}$ pound = 725.5.

Heat absorbed by $\frac{2}{7}$ pound water in being warmed from 60° to 115° = 15.7.

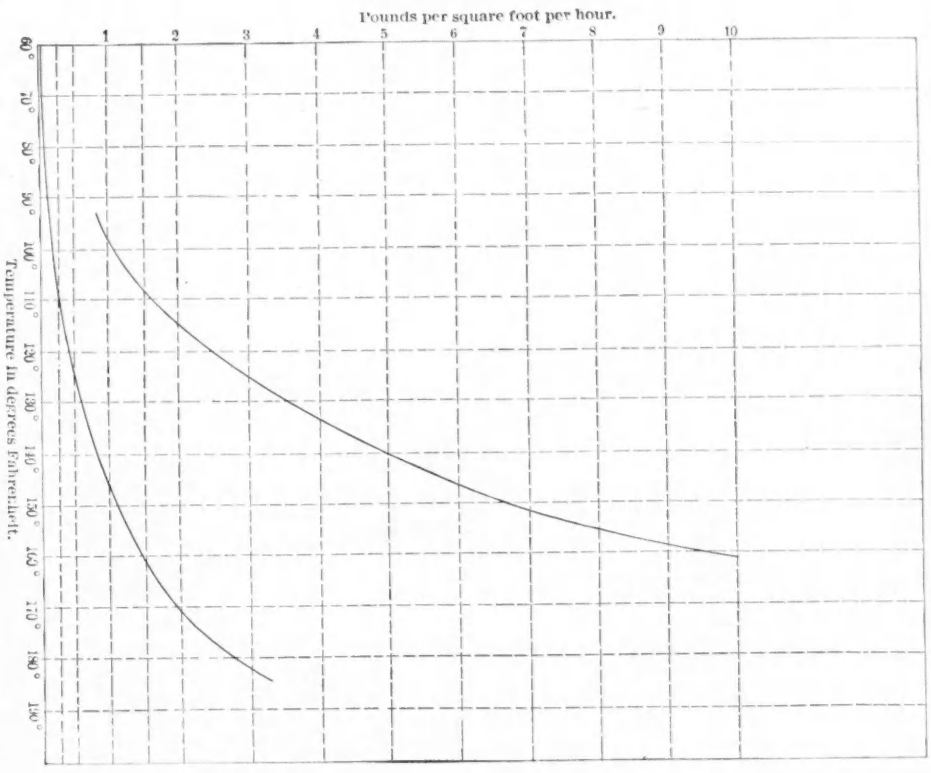
Heat of vaporization of $\frac{2}{7}$ pound = 299.7.

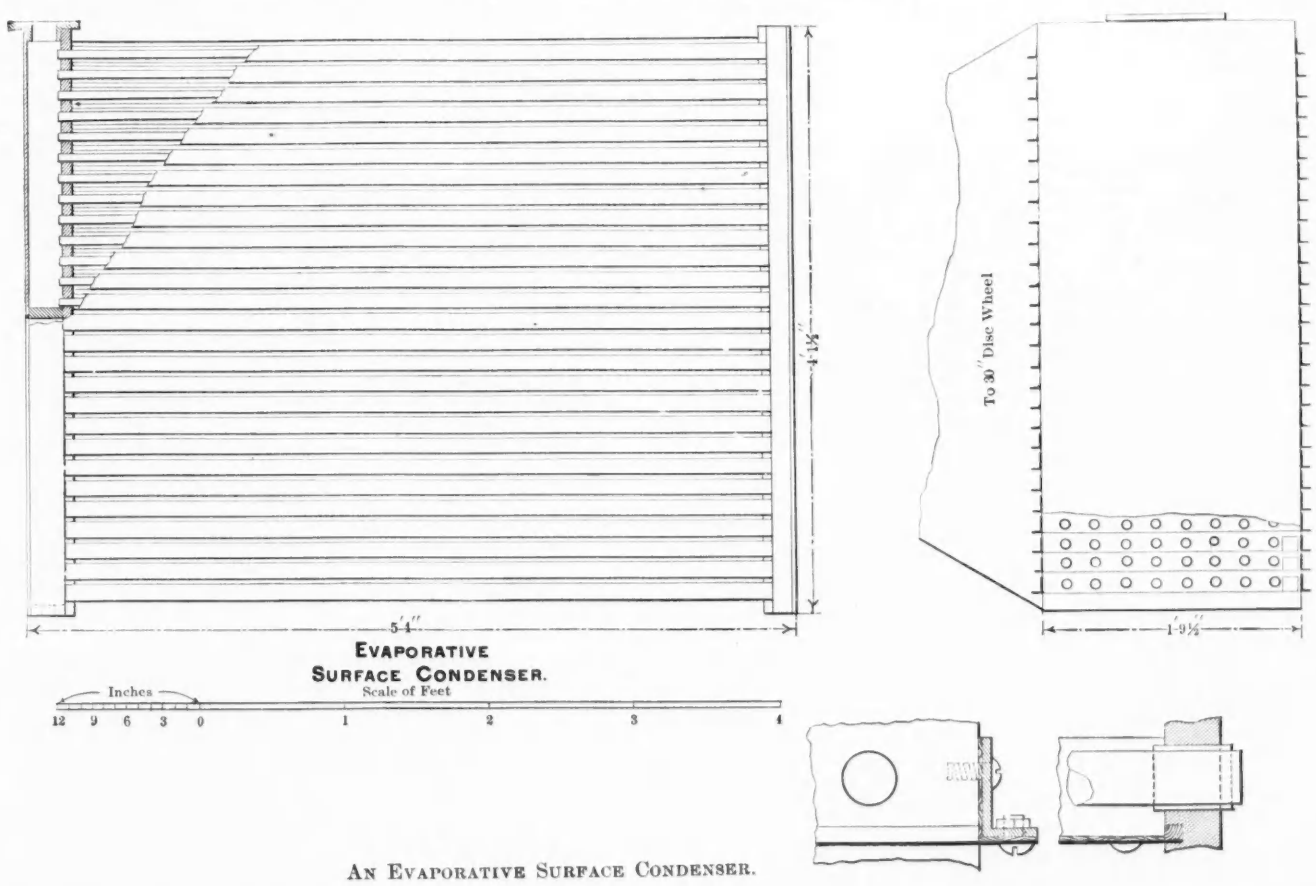
Total heat absorbed by 1 pound water = 57.1 + 725.5 + 15.7 + 299.7 = 1,098.

The cooling water required, then, is practically equal in amount to the steam used by the engine. And since consumption of steam is reduced by the application of a condenser, its use will actually reduce the total quantity of water required.

This condenser is still in a crude form, and there are many improvements to be made in it. One of these is obvious: to cool the water of condensation still further by passing it through an attachment similar to the usual type of surface condenser on its way to the air pump, through which the cooling water first circulates. Enough has been done, however, to demonstrate that it is of practical application in any situation; that it is not expensive to construct, is perfectly accessible for cleaning, requires small power to operate, and will give a vacuum of 20 to 22″. The floor space required is moderate.

A curve showing the rate of evaporation per square foot of surface is given and also one showing the rate when a current of air of about 2,300 feet per minute *velocity* is passed over its surface. The barometer reading averaged 27.9 inches during both sets of observations; the dew point for those in still air was 57°, and for those under a current of air, 68°.





AN EVAPORATIVE SURFACE CONDENSER.

Boiler pressure, lbs. per sq. in. per gauge.	Temperatures in Fahr. Degs.							Working strokes of air pump.	Revolutions of exhaust fan per min.	Velocity of air in feet per min.	Quantity of air moved in cu. ft. per min.	H. P. expended in driving fan.	Barometer in inches.	Cooling water used per hour in pounds.	Steam condensed per hour in pounds.	Vacuum in inches of mercury.	Vacuum reduced to barometer at 30.
	Steam.	Cooling Water (initial).	Water in pans above diaphragm.	Water in pans below diaphragm.	Hot well.	Air.	Dew point.										
65	311	60	140	115	149	70	62	90	740	2,300	6,500	½	28	1,350	900	16½	18½

Prof. L. P. Breckenridge, formerly of the Michigan Agricultural College, writes us in regard to his acceptance of the Chair of Mechanical Engineering at the University of Illinois, at Champaign:

I shall enjoy being associated with other men that are working in other branches of engineering. The work here will be more like that at Lehigh University, where I was for eight years with Professor Klein. We have here shops for woodwork, foundry work, forge and machine work. We shall add new tools to all departments this fall—new grinding machine and planer will be first on our list. Professor Van Dervoort, who was my assistant at M. A. C., comes here with me and will have charge of the shops and work in machine design. Mr. Curtiss, who was foreman of wood-shop at Lansing, has taken similar position here. We are in hopes to do good work in this department.

At a meeting of the Paris Academy of Sciences on August 14th, MM. Delahaye and Boutille showed an ingenious fire-alarm. A hollow ball of aluminum, 15 to 20 mm. in diameter, is supported at one end of an arm, with a counterpoise at the other end, the whole being in equilibrium at the ordinary temperature and pressure of the air. The apparatus, *Nature* says, is purposely made not sensitive enough to show the ordinary natural changes of pressure, but if the specific gravity of the air becomes diminished considerably, either from a rise of temperature or an admixture of coal gas in sufficient quantity to become explosive, the balance is destroyed, and the ball in falling completes an electric circuit by which an alarm bell is set ringing until the normal state of affairs is again established.

M. Defforges has communicated to the Académie des Sciences the result of his researches respecting the distribution of the intensity of gravity over the face of the globe, which he states is by no means uniform or regular. The law of Clairut does not hold universally, and is almost everywhere subject to remarkable anomalies. Upon the coasts of different seas the force of gravity exhibits slight discrepancies, which are constant for the same coast, and therefore characteristic enough of that particular locality. In islands there is a considerable increase in the same force, while the contrary takes place when the venue is changed to a continent. In the latter instance the deficiency appears to suffer an augmentation proportional to the altitude and the distance from the sea.

MANUFACTURES

Stamp & Morris, Cartersville, Ga., are building a steam plant.

The Lakeside Nail mills, Hammond, Ind., are again in operation.

The Buffalo (N. Y.) Heating and Ventilating Co. will construct a plant.

The Washington Carbon Works, Washington, Pa., have resumed work.

George Ray and others will establish a large shoe factory in Quebec, Que.

The American Tin-plate Factory, at Elwood, Ind., has resumed operations.

The Paige Tube Co., Warren, Ohio, has resumed operations, with 400 employes.

The Brown-Bonnell Co. contemplates erecting a new blast furnace at Youngstown, O.

The Enterprise Electric Railway Company will extend its system at Charleston, S. C.

The Cumberland Electric Light and Power Co., Nashville, Tenn., will build to its plant.

The Rider Engine Works, at Walden, N. Y., have resumed, with a full force on full time.

Rabbeth & Dunlap are erecting a grain elevator at their flouring-mill at Clarksville, Tenn.

The Slatersville Mills in Rhode Island have started up after a shut-down of two months.

The East Chicago Foundry, at Hammond, Ind., closed for some time, has resumed operations.

The Barbour Machine Works, at Anniston, Ala., is in the market for pulley-molding machinery.

The Remington Arms Company's Works at Ilion, N. Y., are in operation, with a full force of men.

The East Lebanon (Pa.) Iron Company will rebuild on the old site its plant burned last April.

A. J. Cranor, of Winchester, Ind., will establish the manufacture of barrel hoops at Baton Rouge, La.

The New Bedford Copper Works, at New Bedford, Mass., has started its plant after a temporary shut-down.

A water-works system is to be constructed at Franklin, Kansas. Mayor M. S. Harris can give information.

The Western Tube Company, at Kewanee, Ill., has resumed operations, employing at once several hundred men.

The Darnell Iron-mill, at Muncie, Ind., resumed operations again last week, and all the men are now at work.

It is reported from Elwood, Ind., that work on the plant of the Raub Locomotive Works will begin within 30 days.

The works of the United States Car Company, at Anniston, Ala., are now in full operation, turning out 8 to 10 complete cars per day.

The trouble with the puddlers at the American Sheet-mills, at Phillipsburg, N. J., has been settled, and the mills have started full time.

At Virden, Ill., about $6,000 has been subscribed for the purpose of putting in water-works. J. A. Bronaugh has the matter in charge.

The Graham Manufacturing Company, at Orange, Conn., has been organized; capital stock, $20,000. It will deal in hardware and metals.

The Whiteley Malleable Iron Works, of Springfield, O., has started up its plant with 200 hands. More men will be put on in a few days.

The Record Foundry and Machine Company has commenced the enlargement of the molding department at its plant, at Moncton, N. B.

The Bass Car Wheel Foundry, of Memphis, Tenn., has commenced the construction of a large building, and is rapidly pushing it to completion.

The Interchangeable Tool Co., at Boonton, N. J., has accepted offers of money and land from Utica, N. Y., and will remove its plant to that city.

Parker, Field & Mitchell, engineers and machinists, of Cambridge, Mass., will begin early this fall the erection of new and extensive shops.

It is expected that the Danversport (Mass.) rolling-mill will be started up again soon, and the old employes will be called back to their places.

The Thomas-Roberts Stevenson Company will erect a new foundry building and a storehouse at their stove foundry at Philadelphia, Pa.

Fires have been placed under the glass tank at Whitall, Tatum & Co 's Glasstown (N. J.) Works. This will give employment to about 250 persons.

Work has been resumed at the Cohoes Rolling-mill, at Cohoes, N. Y. and the full force of hands numbering about 400, have been given employment.

The locomotive roundhouse to be built by the Chicago, Burlington & Quincy Railroad, at Luther, near St. Louis, will have 30 stalls, and cost $46,000.

The Altoona (Pa.) Rolling-mill, which has been idle for the last three months, resumed work last week. Several hundred men were given employment.

The stove foundry of Baldwin & Graham, at New Castle, Pa., has been started up after an idleness of several weeks. About 200 hands are employed.

The Clark Foundry and Machine Works, of Knoxville, Tenn , which was destroyed by fire recently, will be rebuilt. The plant was valued at $20,000.

The Bonnie May Phosphate Mines, at Pemberton, Fla., want a 25 horse power portable engine and boiler, elevators, pulleys and shafting, belting, and tools.

It is stated that the Cardwell Machine Company will erect a new plant at Richmond, Va , at a cost of $100,000. The entire plant will cover an area of 160x220 feet.

At a meeting of the stockholders of the Springfield (Ill.) Boiler and Manufacturing Company, it was decided to increase the capital stock from $18,000 to $78,000.

The Salem Iron Works, of Salem, N. C., contemplates applying for a charter of incorporation and doubling its capital, in order to provide for its increasing business.

Five of the largest mills of the Illinois Steel Company, at Bayview, Wis., will resume operations within a week, giving employment to between 1,200 and 1,500 men.

The Hills Company and G. B. Burnett & Sons, of Amherst, Mass , have agreed not to open their respective hat shops until October 2d, when they will start in with a full force.

A. J. Weed & Co., 106 Liberty street, New York, have issued a new edition of their complete catalogue of models, tools, castings, and experimental materials. It will be sold for twenty cents.

The Southern Pump Co., at Birmingham, Ala., has resumed operations, after being closed some weeks on account of the depression in business. It is a young industry, employing 25 hands.

The scythe shops of the American Edge Tool Company, at Ballston, N. Y., which were burned last fall and have since been rebuilt, have resumed work, giving employment to about 200 men.

The Flemington (N. J.) Iron Pipe Works, which have been idle for a year, were recently bought at sheriff's sale by John Foren, of Quakertown, Penn. The works will be started up at once.

Plans and specifications are now being prepared by the Thornton Worsted Co., of Olneyville, R. I., for the construction of a new mill, to be built upon the site of the one recently destroyed by fire.

The Hamilton Woolen Company, Amherst, Mass., which has been working its mills every other week, has posted notices that it would begin running on full time Monday, October 2d. The company employs 800 hands.

The Allen Foundry Company, of Detroit, Mich., has sold its entire plant to the Ideal Manufacturing Company, adjoining property owner, who will continue the plant in operation in connection with its own business.

The Keating Bicycle Works at Holyoke, Mass., will start up at once with increased help. The company has the facilities for getting out several hundred wheels a week. It is expected that about 250 hands will be employed.

Recently the Lodge & Davis Machine Tool Co., of Cincinnati, Ohio, have received from the U. S. Government a large order for machine tools to be used in the manufacture of guns, etc., at the navy yards at Washington, D. C.

The Granite Railway Signal Co., of Pittsburgh, has been granted a charter for the manufacture of railway danger signals. The capital stock is placed at $100,000, and is held by John G. Bennett, John S. Shepherd and Wm. H. Brown.

Chas. Munson Belting Co., Chicago, Ill., issues a catalogue of belting and appliances, which, in addition to information given to the trade, contains tables and information that will be found useful to those who have belting in charge.

C. W. Hunt Co., New York, have issued a new and very complete catalogue of coal-handling machinery, of which they are large manufacturers. A great variety of machinery and appliances for handling coal are illustrated and described.

Assignee H. J. Baker, of the Terre Haute Car and Manufacturing Co , Terre Haute, Ind , has filed a petition in the circuit court for an order to permit the company to rebuild a portion of the burned plant. The judge granted the petition.

H. W. Green, of 254 Fulton street, Brooklyn, N. Y., is introducing a new belting, which is a combination of canvas and crimped steel wire, charged with waterproof material. It is said to be much stronger and more durable than leather belting.

The Davy Steam Sewer, Ditching and Manufacturing Co. has been formed in Chicago, for the manufacture of ditching machinery and the construction of sewers; incorporators, John Dierke, William Davy and E. J. Davy; capital stock, $250,000.

The Springfield Electric Light Company has begun the erection of a building at Indian Orchard, Mass., on the old mill site, and expects to have in operation by the first of next month a 100 horse-power dynamo, capable of running 50 arc and 700 incandescent lights.

The Cortland Wagon Company, at Cortland, N. Y., started work last week with a full force and on full time. About 500 hands are employed. The works have been idle about two months. The Cortland Omnibus and Cab Company has started half its force at work.

Articles of incorporation of Caton's Foundry and Machine Company have been filed at San Jose, Cal. The capital stock of the company is $50,000, divided into 5,000 shares of $10.00 each. The Board of Directors for the first year are F. E. Caton, B. T. Bailey, F. B. Warring, W. T. Reese and David Johns.

The Pittsburgh Tool and Steel Company have been chartered at Harrisburg, Pa., with a capital stock of $100,000, the directors being John C. Jamison, David H. Summers, Richard W. Bailey, David P. Thomas and Alex. M. Johnston. The plant of the Greensburg Steel Company, at South Greensburg, Pa., was recently purchased by these parties, which leads to the belief that these works will shortly be put into operation.

A new factory, at Haverhill, Mass., proposes to manufacture solid silverware, with plated goods as a secondary line. Cutlery, hollow and flat ware will be produced. Among the goods will be the finer grades of pearl and ivory and embossed and engraved handles, such as have been heretofore imported from England. The factory will give employment to 300 skilled workmen, and its pay-roll will be $5,000 weekly. The capital to be invested is $300,000, and the yearly product is estimated at $1 000,000.

"MASON REGULATOR CO.,
BOSTON.

Gentlemen: Enclosed find order for $2. Please send me 'Engineers' Catechisms' for this amount. I am going out as soon as the books come, and will be out some months. Have orders for half a dozen in town here, and this without any solicitation; young men have seen the book on my desk.

I am, respectfully yours,

(Signed) W. D. TOMLIN,

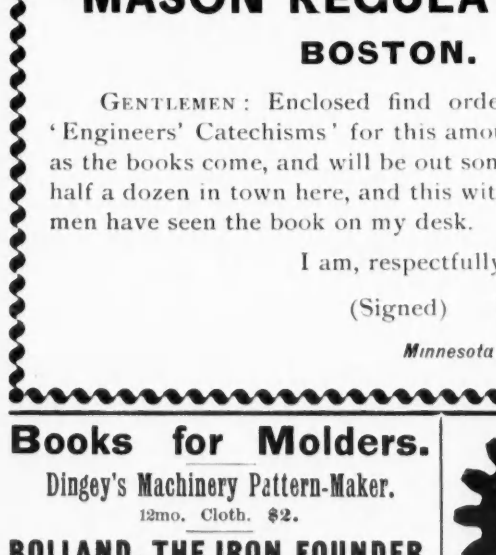
Minnesota State Inspector of Steam Boilers."

Books for Molders.
Dingey's Machinery Pattern-Maker.
12mo. Cloth. $2.
BOLLAND, THE IRON FOUNDER.
12mo. Cloth. $2.50.
JOHN WILEY & SONS, - NEW YORK.

GRANT GEARS
Ready Made Cut Gears.
Ready Made Cast Gears.
Ready Made Brass Gears.
Gears Made to Order.
Gear Cutting.
Gear Book, 15 cents.
Treatise on Gears, $1.00.
Gear Cutting Machines.
GEORGE B. GRANT,
Lexington, Mass.,
and 125 South 11th St.,
Philadelphia, Pa.

FITCHBURG MACHINE WORKS,
MANUFACTURERS OF THE CELEBRATED
FITCHBURG MODERN ENGINE LATHE
AND OTHER METAL-WORKING MACHINES,

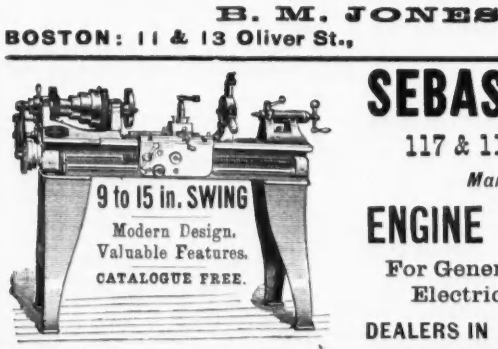
48-inch Planer.
SEND FOR CATALOGUE E.
FITCHBURG, MASS.

WHEELER CONDENSER & ENGINEERING CO.


39 & 41 Cortlandt St., New York.
MANUFACTURERS OF IMPROVED
SURFACE CONDENSERS.
The Wheeler Admiralty Condenser.
The Wheeler Standard Condenser.
Condensers for Electric Light and Power Stations, Mills, Mines, Ice and Refrigerating Plants. Condensers with and without pumps.

THE DEANE
OF HOLYOKE
STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

CRESCENT STEEL CO.
PITTSBURG, CHICAGO, NEW YORK.
STEEL FOR Lathe and Planer TOOLS, Cold Chisels, Punches & Dies, Milling Cutters, Molding Bits, &c.
SHEET STEEL, POLISHED Drill Rods, SPRING STEEL, Machinery Steel, COILED SPRINGS, Steel Forgings, ETC.



"Lightning" Screw Plates
For Machinists, Electricians, Bicycle Repairers, &c. Adjustable Dies with Guides.
SEND FOR CATALOGUE.
WILEY & RUSSELL, MFG. CO.,
GREENFIELD, MASS.

"R. MUSHET'S SPECIAL STEEL"
SAVES LABOR in being able to run at GREATLY INCREASED SPEEDS. FEWER GRINDINGS. No WASTE in redressing.
Sole Representatives in the United States.
B. M. JONES & CO.,
BOSTON: 11 & 13 Oliver St., NEW YORK: 143 Liberty St.

SEBASTIAN LATHE CO.
117 & 119 Culvert St., Cincinnati, O.
Manufacturers of Foot and Power
ENGINE AND SPEED LATHES,
For General Machine and Jobbing Shop, Electrical and Experimental Work.
DEALERS IN MACHINISTS' TOOLS AND SUPPLIES.

ASBESTOS
SMOKE STACK PAINT

Used on the ships of the U.S. Navy and by the prominent Steamboat and Transportation Companies. The only paint supplied in colors which has given absolute satisfaction where forced draught is used.
READY FOR USE
ALL ORDINARY SHADES.
H. W. JOHNS MFG CO.
87 MAIDEN LANE, NEW YORK.
NEW YORK JERSEY CITY CHICAGO PHILADELPHIA BOSTON LONDON

The effects of increased business are felt in the neighborhood of Bridgeport, Conn , in the starting up of mills that have been running on half time, and with only half the usual number of hands employed. There is also a feeling of confidence among the merchants. Reports from towns in the Naugatuck Valley indicate that the same condition of affairs prevails there. From Bridgeport to Winsted, in Litchfield County, a distance of about fifty miles, there are a dozen or more towns, all of which are hives of industry. In Torrington the Coe Brass Company, the largest concern of the kind in the United States, the Excelsior Needle Company, where nearly all the sewing machine needles used are turned out, and half a dozen other concerns, each doing a large business, have started up again, and there is every prospect that there will be work for the thousands of employes who have had nothing to do for weeks.—*The Evening Post.*

Machinists' Supplies and Iron.

NEW YORK, September 30, 1893.

Iron—American Pig—We quote Standard Northern brands, No 1 Foundry, $14.50 to $15.00; No. 2, $13.50 to $14.25; Gray Forge, $12.25 to $12 50. Southern brands of good quality are obtainable at $13.75 to $14.50 for No. 1 Foundry; $12.50 to $13.50 for No. 2, and $11.75 to $12.50 for Gray Forge.

Antimony—The market is steady and dull. We quote L. X., 9.90c. to 10.10c.; Cookson's, 10¼c. to 10½c.; Hallett's, 9¾c. to 9⅞c., and U. S. French Star, 10c.

Copper—The market for Lake Copper is dull. Spot is scarce and held at 9⅞c.; futures may, perhaps, be bought at a little less. Casting Copper is held at 9¼c. to 9.40c.

Lead—The market is inactive; prices are a little lower, 3.75c. to 3.80c. being asked. These prices tend to bring buyers forward

Lard Oil—Prime City is quoted at 74c. to 75c.

Speiter—The market is firm; sellers quote 3.80c. to 3.87½c. for New York delivery. Buyers are indifferent, and offerings are not liberal.

Tin—The market is fairly active; moderate sales have been made at 20 75c. to 21c. for spot; 21.05c. to 21.20c. for October, and 21.15c. to 21.30c. for November.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Mech. draftsman with exp. in cranes and hydraulic machinery wants pos. Box 100, Am. Mach.

Exp'd. mech. draftsman, grad., desires pos. Best refs., steam engines preferred. Box 105, Am Mach.

Draftsman & M. E. (graduated in Europe) wishes a situation; good refs. Box 78, Am. Machinist.

Wanted—Permanent position by first-class patternmaker. Address G., American Machinist.

A young, married man with 5 years' experience in machine shop desires pos. Best ref. Address Wm. Heather, care American Machinist.

Draftsman (designer) experienced on mach. tools, jigs, fixtures and gen'l mach'y desires position. Box 76, American Machinist.

Wanted—Situation by mechanical draftsman, 6 yrs.' exp. on mach. tools and general machinery, good designer. Address Box 109, Am. Machinist.

I want position as traveling salesman, supplies or specialties. Large acquaintance and exp. A1 refs. Box 103, American Machinist.

Wanted—Machinist and pattern maker as partners in an iron foundry in St. Louis; young men each with $500 or more; a good opening. Write J. McCash, 619 Harris Avenue, St Louis, Mo.

Mechanical engineer wishes position in engineering concern: can invest $1,000 if wanted. Shop and office experience in all kinds of machinery, boilers and structural work. Box 106, Am. Machinist.

First-class practical machinist, with small capital, experienced in handling men, desires position as foreman or partnership in machine shop. Address Box 107, American Machinist.

Wanted—Pos. as draftsman or chief draftsman & constructing eng.; well acquainted with marine & shipbuilding work in all details as designer; also stationary engines, structural iron work, etc. Highest refs. as to ability. Box 108, Am. Mach.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E O. Chase, Newark, N. J.

Shapers 6" and 12", $75, $150; lathes, planers, drills, tools at panic prices. 229, Am. Machinist.

Rubber, metal and composition patterns for carding & grouping; small rubber & metal work to order. John T Usher, 116 E. 54th St., New York.

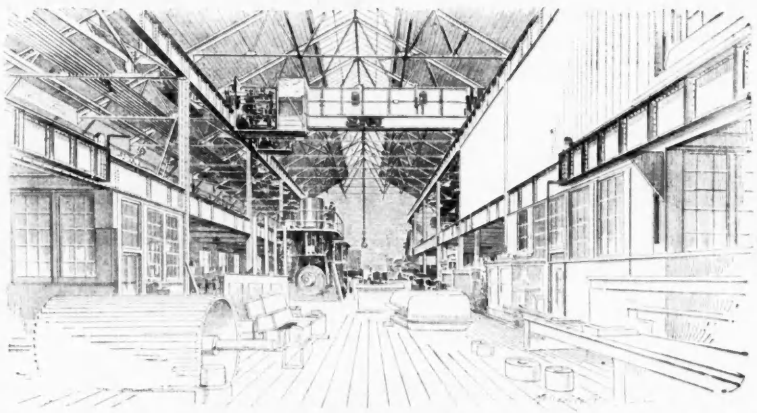
Modern Machine Shop Practice, by Joshua Rose. 30 numbers complete, perfectly new; cost, $15; will sell to the highest bidder. Address Lock Drawer 820, Bridgeport, Conn.

DON'T ACCEPT ANY SUBSTITUTE FILE.
INSIST ON HAVING
NICHOLSON.

NICHOLSON FILE CO.
PROVIDENCE, R. I., U. S. A.
3000
VARIETIES FILES
[X. F.] & INCREMENT CUT FILES.

THE BERLIN IRON BRIDGE CO.
Office and Works,
No. 8 Railroad Ave., East Berlin, Conn.
CHAS. M. JARVIS, Pres. and Chief Engineer. BURR K. FIELD, Vice-President.
FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary

Engineers, Architects and Builders of



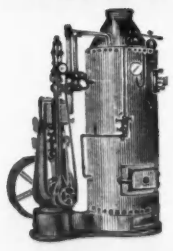
Iron and Steel Bridges and Buildings.

The above illustration is taken direct from a photograph and shows the interior of a Machine Shop designed and built by us for The J. Morton Poole Co., at Wilmington, Del. The building is 87 feet in width by 157 feet in length. The central portion of the building is 36 feet in width and of sufficient height to set up heavy marine engines under the traveling cranes.

SEND FOR OUR ILLUSTRATED CATALOGUE.

PRATT INSTITUTE,
BROOKLYN, N. Y.
Department of Science and Technology.
The two years' Day Course in machine work gives a thorough preparation for practical work. Tuition $30.00 per term of six months. Evening Class meets on Monday, Wednesday and Friday of each week for course of six months, beginning September 25. This course affords the best possible opportunity for beginners at the trade to obtain a thorough training in the use of all the shop tools. Tuition for term of six months, $15.00. Tools and materials furnished without extra charge. For tuition and further particulars, address,
F. B. PRATT, Secretary.

COOKE & CO.,
163 & 165 WASHINGTON ST.,
NEW YORK.
ENGINES and BOILERS.



VERTICAL,
HORIZONTAL,
STATIONARY,
PORTABLE,
Plain and Automatic.
Write for Catalogue and mention this paper.

VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

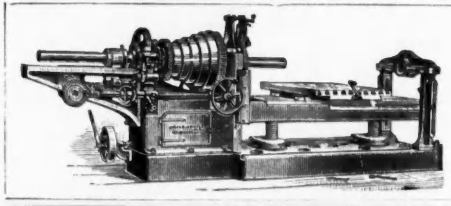
The Elliott Drill Press
FOR ANY LIGHT WORK
LARGE RANGE OF WORK - LOW PRICE

Now Manufactured by
A. J. WILKINSON & CO.,
180 to 188 WASHINGTON ST., BOSTON, MASS
SEND FOR CATALOGUE.

REDUCED PRICES OF LeCOUNT'S LIGHT STEEL DOG.

No.	INCH.	PRICE.	No.	INCH.	PRICE
1	⅜	$ .35	8	2	$1.10
2	½	.35	Small set of 8—5.50		
3	¾	.50	9	2½	1.40
4	1	.60	10	3	1.50
5	1¼	.75	11	3½	1.70
6	1½	.85	12	4	1.90
7	1¾	1.00	Full set of 12—12.00		

C. W. LeCOUNT, South Norwalk, Conn.
These goods are for sale by CHAS. CHURCHILL & CO., L't'd, 21 Cross St., London, England.



BETTS MACHINE CO.,
WILMINGTON, DEL.
MACHINE TOOL BUILDERS.
IMPROVED PATTERNS! LATE DESIGNS!
Chicago Office: 14 South Canal St.

JESSOP'S STEEL
FOR TOOLS, DRILLS, DIES, &c.
ALL KINDS IN STOCK.
Manufactory, SHEFFIELD, ENG.
Chief Am. Office, 91 JOHN ST., N. Y.
WM. JESSOP & SONS, LD.
Established a century ago.

"Star" Foot Lathe Swings 9x25 in.
LATHE
Screw Cutting Automatic Cross Feed, etc.
LATHE
Scroll Saws, Circular Saws, Lathes Mortisers.
LATHE
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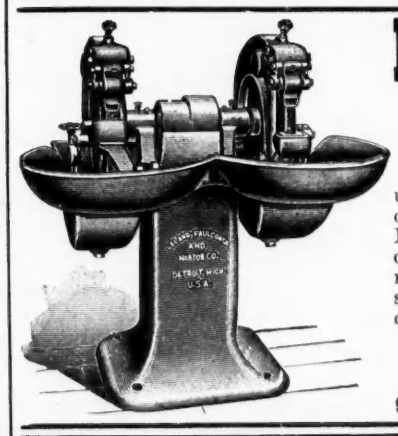

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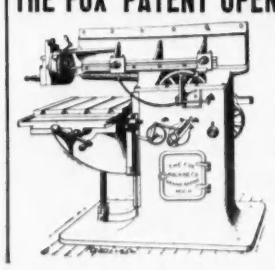

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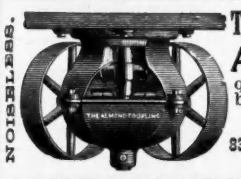

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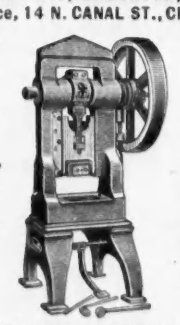

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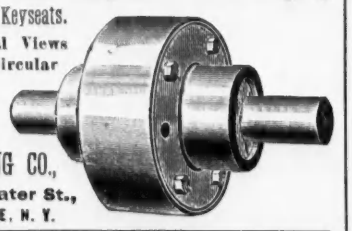

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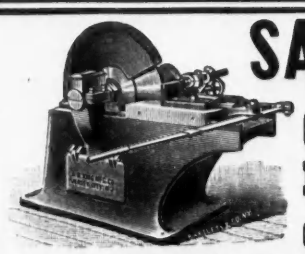

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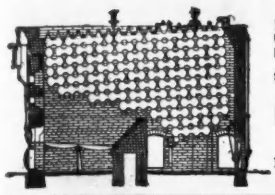

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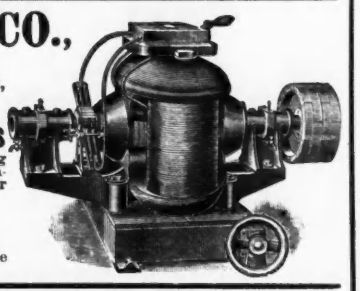

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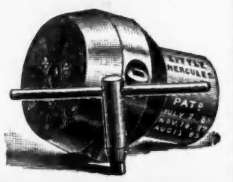

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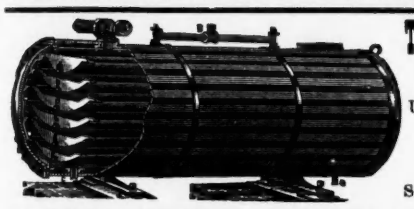

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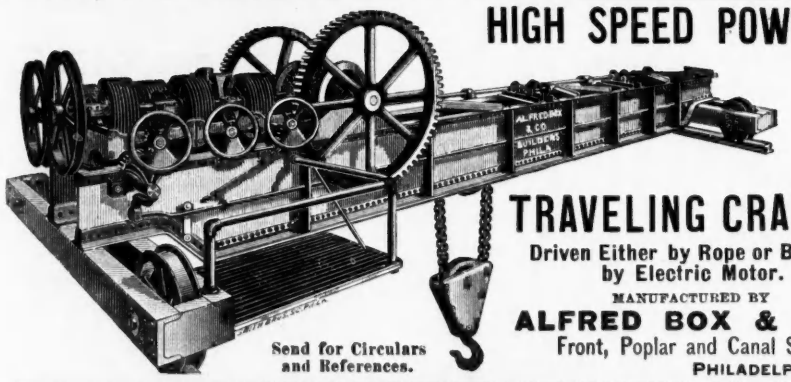

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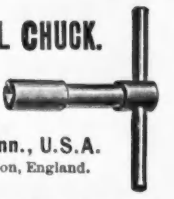

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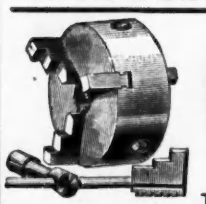

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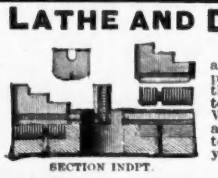

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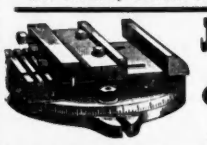

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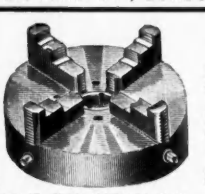

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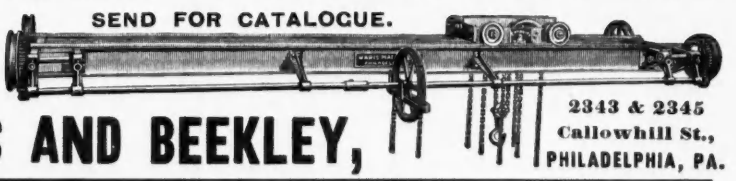

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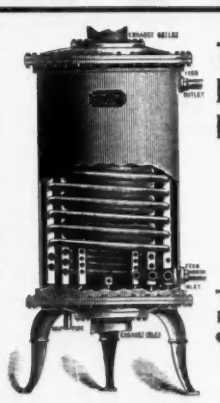

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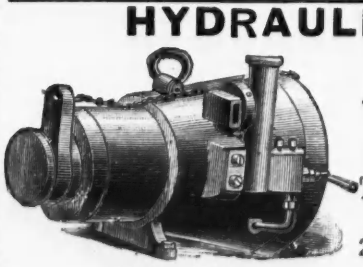

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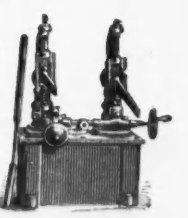

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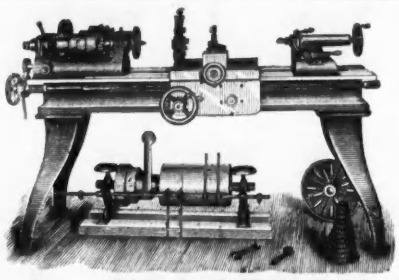

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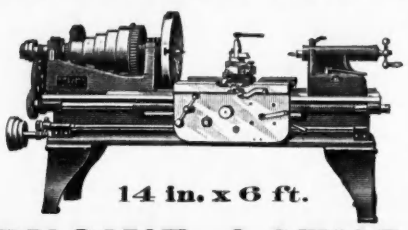

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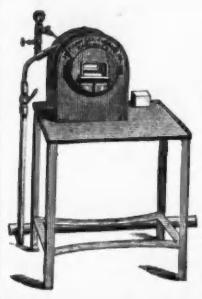

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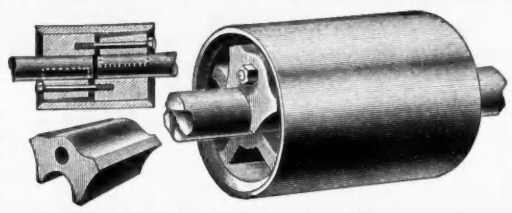

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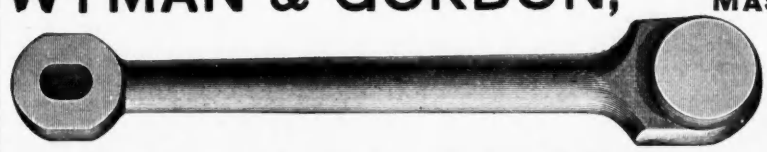

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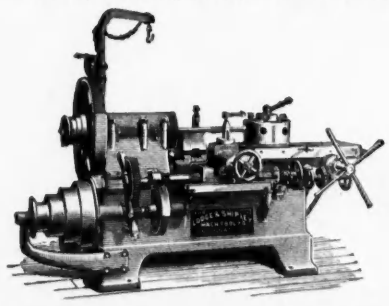

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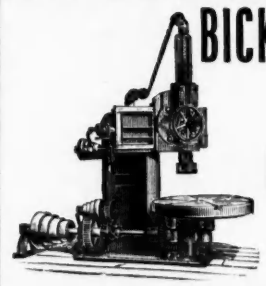

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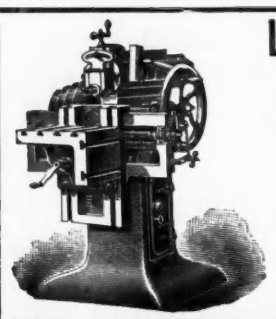

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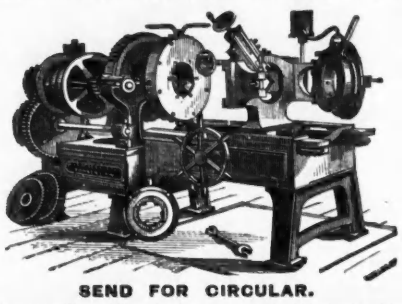

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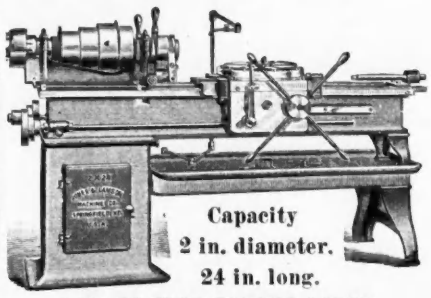

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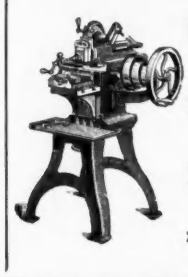

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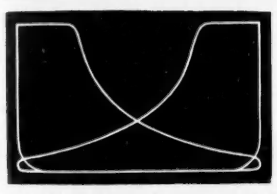

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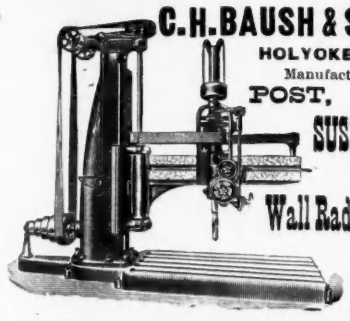

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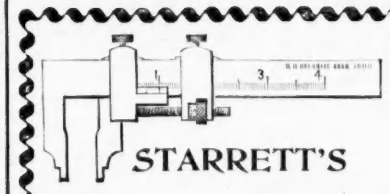

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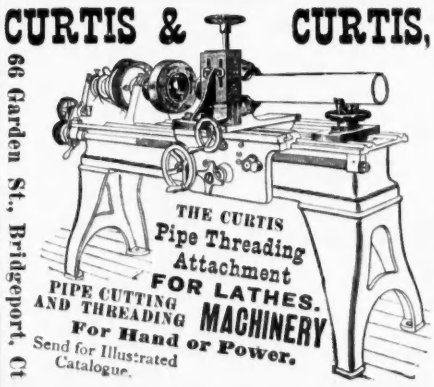

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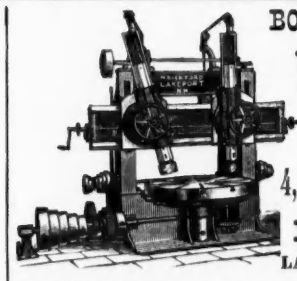

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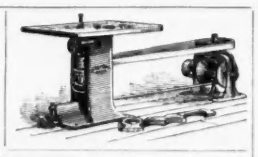

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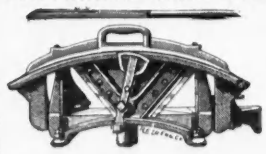

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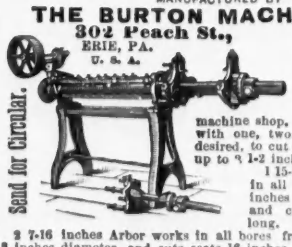

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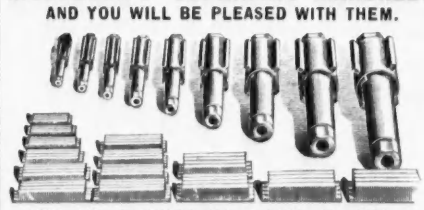

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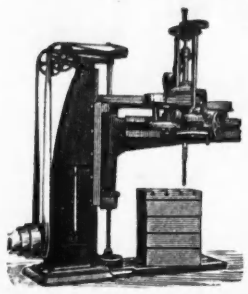

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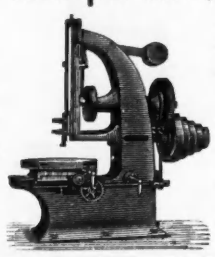

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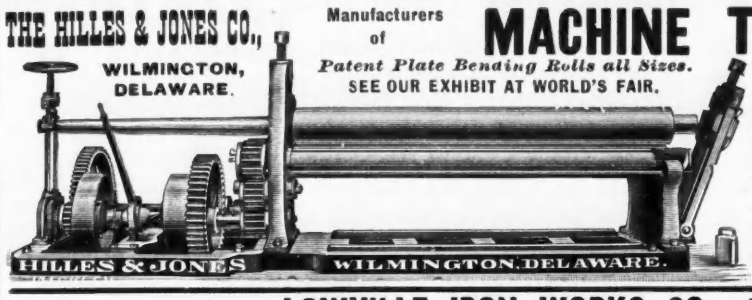

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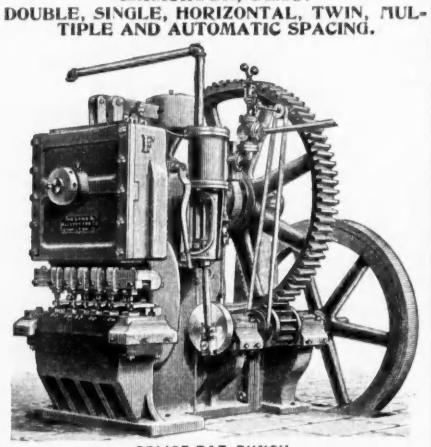

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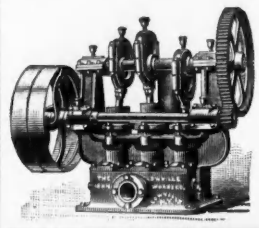

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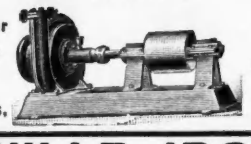

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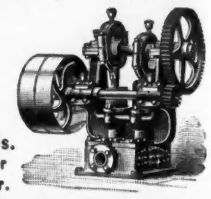

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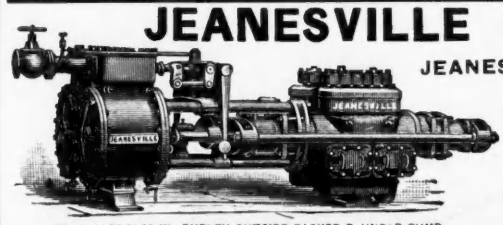

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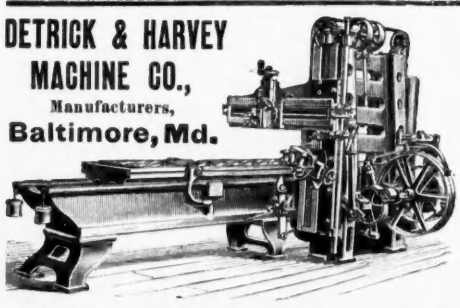

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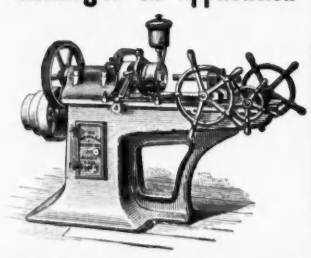

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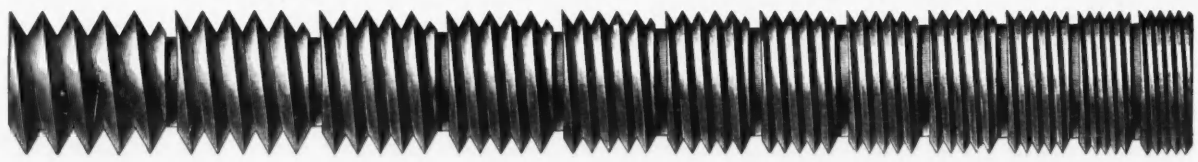

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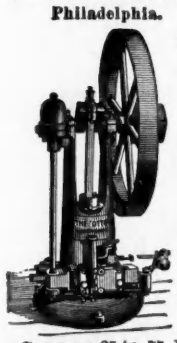

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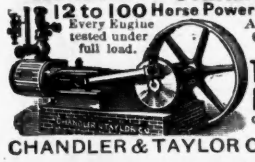

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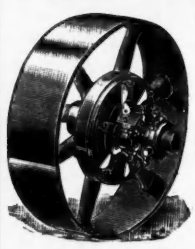

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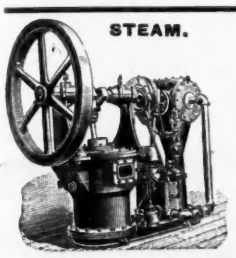

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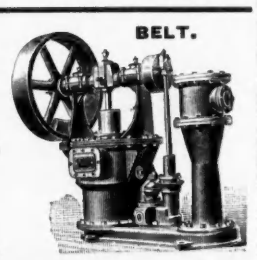

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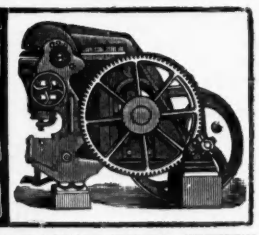

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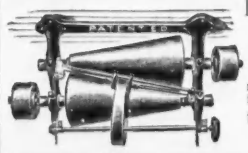

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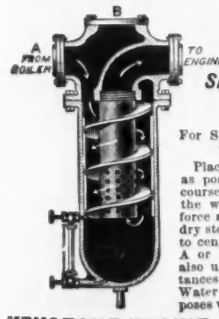

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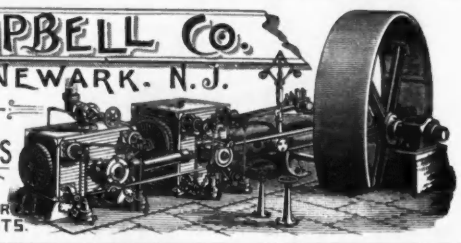

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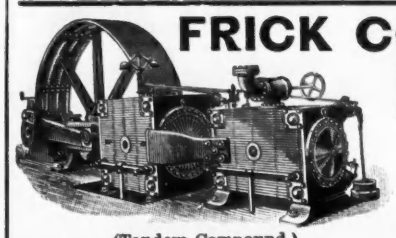

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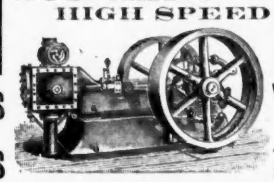

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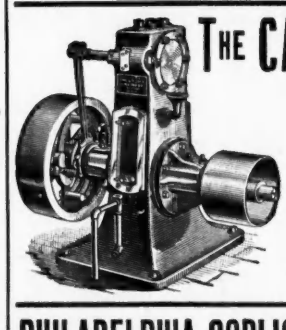

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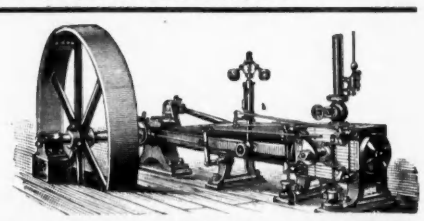

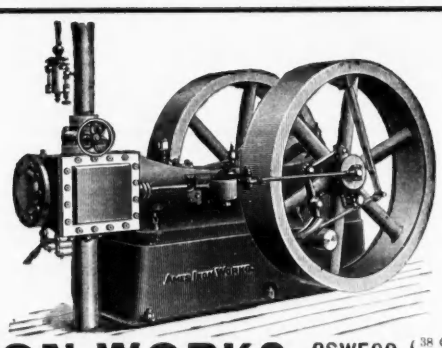

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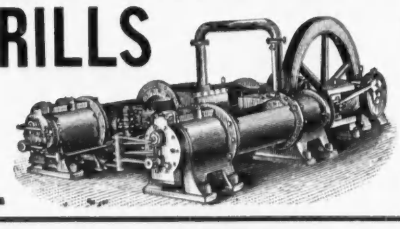

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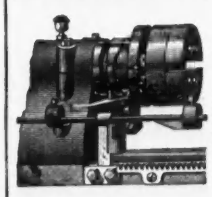

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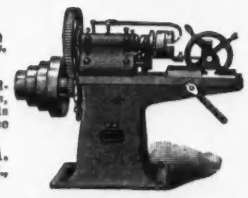

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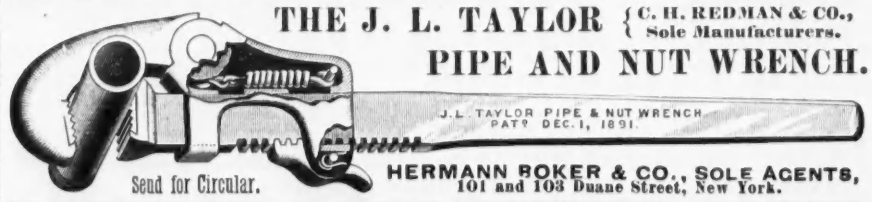

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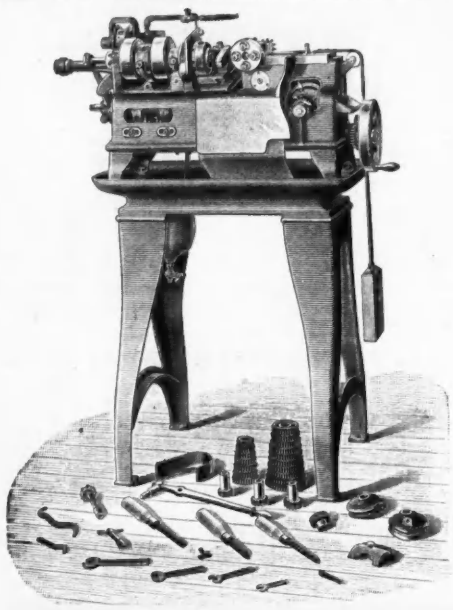

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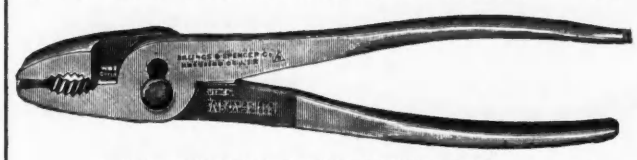

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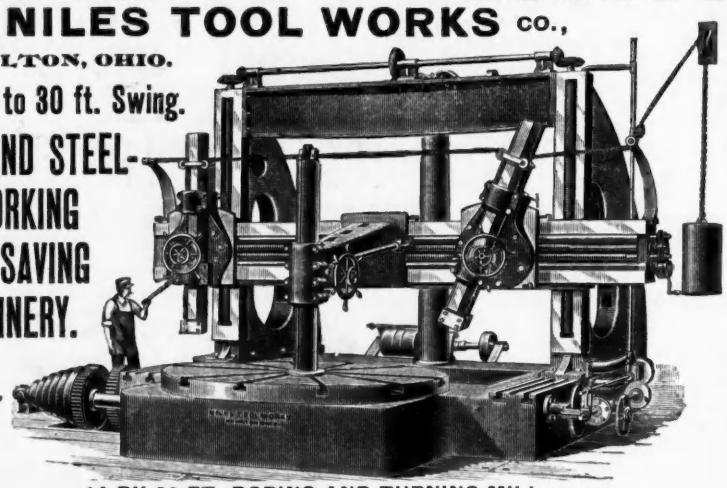

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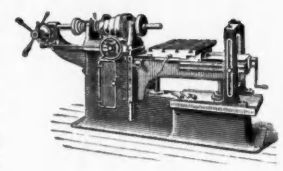

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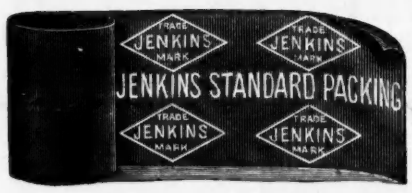

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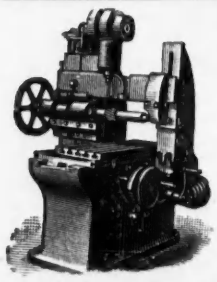

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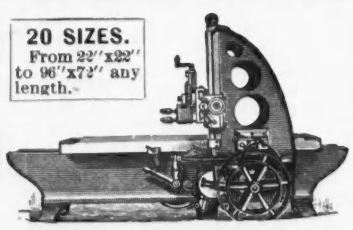

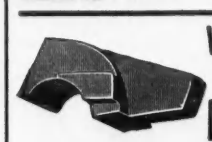

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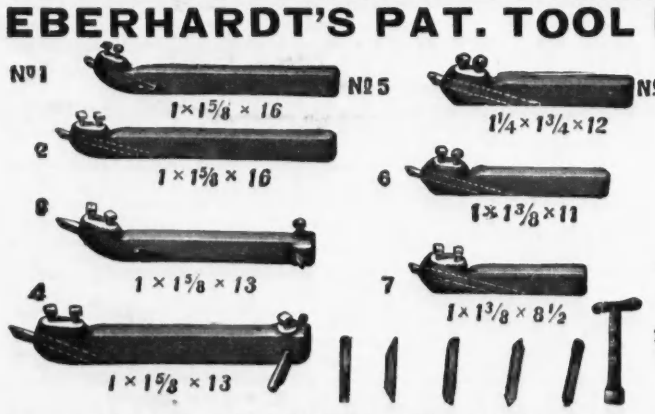

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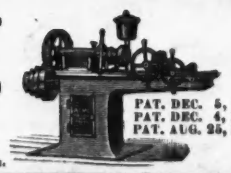

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